Essays in sports economics

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The Faculty of Business, Economics and Informatics of the University of Zurich hereby authorizes the printing of this dissertation, without indicating an opinion of the views expressed in the work.

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FRAMEWORK PAPER

CORNEL NESSELER

The dissertation consists of three papers which discuss sports economics topics. The methodology in each paper depends on the idiosyncratic research question. A theoretical approach for the first paper best fits to the paper's research question. For the second and third paper an empirical approach is more appropriate. The results of each paper depend on the methodology we use. After the methodological description we describe, evaluate, and discuss the results in each paper.

The first paper (pp. 4-24), "The Impact of Government Subsidies in Professional Team Sports Leagues", examines the effects of subsidies in a professional team sports league. For this purpose, we use a game theoretic model. We model a league with a large and a small market club. In our approach we focus not only on competitive balance and winning percentage but also on aggregate talent. Aggregate talent measures the total amount of talent in a league. Additionally, we include fan preferences for aggregate talent. Thus, fans can have different preference levels for the total amount of talent. This is an important distinction as fans might favor competitive balance and winning percentage over aggregate talent and vice versa.
To evaluate the effect of subsidies we observe their effects on player salaries, competitive balance, club profits, and social welfare. We find that the effect of the subsidy depends on the recipient (i.e., large or small market club) and the amount of fan demand for aggregate talent.
When a large market club receives a subsidy and fans have a relatively strong preference for aggregate talent, then aggregate club profits and welfare increase. Club profits increase for both clubs. Competitive balance decreases. Team winning percentage further increases for the large market club.
In the other case, the small market club receives a subsidy. A relatively small subsidy leads to an increase in competitive balance and player salaries for

the small and the large market club.
The results for both cases have important policy implications. We show that subsidies can have positive effects for all clubs in a league even though only one club receives a subsidy. When fans from both clubs have a high preference for aggregate talent, all teams can benefit. When fans have a low preference for aggregate talent then a subsidy shifts mainly competitive balance and winning percentage. In this case, only the club receving the subsidy benefits.

The second paper (pp. 25-41), "Momentum in Tennis: Controlling the Match", examines how tennis players benefit from a psychological or physiological advantage (momentum). Therefore, we empirically analyze approximately 3'000 tennis matches by using a regression with robust standard errors.
In contrast to previous work in the area of momentum, we include the actual outcome of the second to last set. In previous research the outcome of the second to last set was reduced to a binary variable. However, winning the second to last set with the largest possible margin (i.e., 6 – 0) or with the smallest possible margin (i.e., 7 – 6) makes a significant difference. Additionally, we include the round of a match (e.g., whether players meet in the first round or in the final).
Other variables we include, which have also been included in previous research, are player skill set (ATP ranking), tournament (ATP or Grand Slam), gender, and home advantage.
We find that players benefit from momentum as long as they control a match. Players are controlling a match when they win the second to last set with a relatively high margin. The control declines when the margin shrinks. Once players lose control over a match, we find that they have a significantly lower chance to win the next set than their opponent. This loss of control results in what we define as anti-momentum. Anti-momentum means that players have a lower chance to win the last set even though they won the second to last set.
Our results shed new light on the concept of momentum. We show that while several aspects of momentum for tennis player are important (e.g., ATP ranking), none is as important as the outcome of the second to last set. Thus, the most important variable to determine whether a player benefits from momentum is to observe the outcome in the second to last set.

The third paper (pp. 42-71), “Are Women or Men Better Team Managers? Evidence from Professional Team Sports”, examines if sports clubs fare differently depending on the gender of the manager. We empirically analyze the performance of both male and female managers in the North American basketball league for women (WNBA) and in three European soccer leagues (viz., France, Germany, and Norway). In the North American Basketball league we compare managers which have a similar amount of specialized experience. Specialized experience means that a manager has worked as an employee in the same industry. Thus, in our case specialized experience means that a manager played in the WNBA (or NBA for males). In the European study only female managers have specialized experience. We use a robust regression to detect differences in performance between male and female managers. In the next step we apply the Blinder Oaxaca decomposition to check if performance differences depend on different pre-conditions. This decomposition is used to analyze how and which variables effect a binary variable. In our case the binary variable is either male or female.
We find that, on average, female managers never perform worse than male managers. In the WNBA both females and males with specialized experience perform equally well. In the European case, where female managers have specialized experience, female managers perform equally well as their male counterparts. Our research shows that specialized experience has no effect on performance. Additionally, we find that female managers work under significantly worse pre-conditions. These results have important policy implications for players, managers, and club officials. We show that female managers are in no way harmful for a company’s performance.

THE IMPACT OF GOVERNMENT SUBSIDIES IN PROFESSIONAL TEAM SPORTS LEAGUES

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This article develops a game-theoretical model to analyze the effect of subsidies on player salaries, competitive balance, club profits, and welfare. Within this model, fan demand depends on win percentage, competitive balance, and aggregate talent. The results show that if a large market club receives a subsidy and fans have a relatively strong preference for aggregate talent, compared to competitive balance and own team winning percentage, then club profits and welfare increase for both clubs. If the small market club is subsidized then a small subsidy increases competitive balance and player salaries of both clubs.

1. INTRODUCTION

Government subsidies are a common phenomenon in professional team sports. These subsidies usually take the form of advantageous property deals[1] , tax loopholes[2] , and low or zero stadium rents.[3] As a result of these subsidies, some clubs enjoy cost advantages over their competitors. A special case

[1]The European Commision states that the Spanish soccer club Real Madrid: "appears to have benefited from a very advantageous real property swap with the City of Madrid." (see http://europa.eu/rapid/press-release_IP-13-1287_en.htm)

[2]See e.g., Barcelona CF, Athletic Club Bilbao. For them the European Commision states that they might have received "Possible privileges regarding corporate taxation."

[3]One example for stadium rent is the Dutch soccer club Willem II (see http://europa.eu/rapid/press-release_IP-13-192_en.htm). Clubs that might have benefited by paying no or lower rent for their training facilities are FC Den Bosch and MVV (these are also Dutch soccer clubs).

of these cost advantages are income tax differences with respect to player salaries.

In France, there is a uniform income tax rate. As a result players in the first French division face an income tax rate of 45% if their salary exceeds 150,000. Monaco, on the other hand, does not impose income taxes. Accordingly, players from AS Monaco, who also compete in the first French division, do not pay any income taxes.

In the US, state and city income tax rates also differ substantially. For example, Florida and Texas do not impose state and city income taxes, whereas California charges state taxes of up to 12.3%. The former coach of the Orlando Magic, Glenn Anton "Doc" Rivers, tried to convince free agents of opposing teams to join the Magic by yelling at them during games, "We have no state and city taxes, and it's always 80 degrees."

Kopkin (2012) identifies the effect of changes in income tax rates on player transfers. He finds that an increase in the marginal income tax rate for a given team results in a decrease of the average skill of free agents who transfer to this team. Alm, Kaempfer, Sennoga, and Batte (2012) analyze the same effect in professional baseball and show that low tax cities benefit from a "home field advantage" in the free agent market. To the best of our knowledge, these effects have never been analyzed in a game theoretical model of a professional sports league. Our model builds on former models which have focused on competitive balance and win percentage (see e.g., Dietl, Lang, Werner, 2009; Vrooman, 2008; Szymanski Kesenne, 2004). We follow Madden (2012) by including the effect of aggregate talent on demand. Unlike Madden, however, we explicitly model fan preference for aggregate talent while he uses aggregate talent primarily as an additional factor in the revenue function.

Based on our game theoretical model we show how subsidies affect player salaries, competitive balance, club profits, and social welfare. The results show that if a large market club receives a subsidy and fans have a relatively strong preference for aggregate talent, compared to competitive balance and own team winning percentage, then club profits and welfare increase for both clubs. If the small market club is subsidized then a small subsidy increases competitive balance and player salaries of both clubs.

Our model clearly deviates from classical gate revenue sharing models (cf., Szymanski Kesenne, 2004) because subsidies effect competitive balance and aggregate talent. In classical revenue sharing models aggregate talent is not included. While in the classical gate revenue sharing model competitive balance decreases we show several results in the opposite direction. Additionally, several outcomes in our model result in an increasing competitive balance. The article is organized as follows: Section 2 describes the structure of the model. Section 3 explains the equilibrium outcomes. Section 4 presents the results and explains the intuition. Section 5 sums up the main arguments and proposes options for future research.

2. MODEL SETUP

We model a two-club league in which both clubs participate in a noncooperative game and independently pay a certain amount for player salaries to maximize profits. Each club $k \in \{i, j\}$ generates its own revenues according to a fan demand function that depends on the match quality, i.e., own team win percentage, competitive balance, and aggregate talent.[4]

We introduce the concept of exogenous assistance in the form of a subsidy. In the Lang, Grossmann, and Theiler, 2011 model, outside actors financially assist clubs, thereby influencing a club's objective function. In our model, no outside actor has the possibility of influencing a club's objective function. One example in our case is a regional government that has its own economic interests in supporting a club via tax relief but that cannot directly influence the club's decision-making process.

The gross salaries (salary payments) of club k are denoted by x_k and the net-of-tax salaries s_k the players receive at club k are given by

$$s_k = (1 - \mu_k t)x_k$$

with $t \in [0, 1]$ and $\mu_k \in [0, 1]$. We assume $x_k > 0$. The income tax is denoted by t and the subsidy (tax relief) that club k obtains is presented by the parameter μ_k, where a higher value of μ_k denotes a lower subsidy. For notational simplicity, we substitute the term $(1 - \mu_k t)$ with α_k and obtain

$$s_k = (1 - \mu_k t)x_k = \alpha_k x_k$$

with $\alpha_k \in [1 - t, 1]$. With the new notation, a higher parameter α_k reflects a higher subsidy. In the extreme case, $\alpha_k = 1$ and club k does not have to pay

[4] H. Dietl and Lang, 2008 use a similar approach but without the inclusion of aggregate talent. Aggregate talent is included in a different way in the models of H. M. Dietl, Lang, and Rathke, 2009, and Madden, 2011.

any taxes so that the gross salaries the club pays corresponds to the net-of-tax salary the players receive, i.e., $s_k = x_k$. In contrast, if $\alpha_k = 1 - t$, club k does not receive any subsidy and has to pay the full tax so that $s_k = (1-t)x_k$. While this setup assumes that any revenues from a subsidy are passed on to the salary of the players, a more relaxed assumption is also plausible. By assuming that both clubs i, j forward the same share of the subsidy to their players we relax the general assumption that all tax revenues are forwarded.

Next, we specify the revenue function, which depends on win percentage, competitive balance, and aggregate talent. Win percentage is most commonly represented by the contest-success function (CSF). We select Tullock's (1980) logit approach:

$$w_k(x_i, x_j) = \frac{s_k}{s_i + s_j} = \frac{\alpha_k x_k}{\alpha_i x_i + \alpha_j x_j},$$

with $k \in \{i, j\}$.[5] We use the following measurement for competitive balance:

$$CB(x_i, x_j) = w_i(x_i, x_j) w_j(x_i, x_j) = \frac{\alpha_i x_i \alpha_j x_j}{(\alpha_i x_i + \alpha_j x_j)^2}.$$

If both clubs have the same winning percentage ($w_i = w_j = 0.5$), competitive balance is $1/4$. The opposite case, a league with one dominant club ($w_i = 1, w_j = 0$), has a competitive balance of 0.

Fans value not only competitive balance but also aggregate playing talent within the league.

$$AT(x_i, x_j) = \alpha_i x_i + \alpha_j x_j.$$

Without aggregate talent, supporters are unable to distinguish between teams in a high or low league (assuming that win percentages are the same). By including $\sigma > 0$ to measure the relative importance of aggregate talent, the quality function of club k is

$$q_k(x_i, x_j) = w_k(x_i, x_j) + CB(x_i, x_j) + \frac{1}{\sigma} AT(x_i, x_j).$$

We assume that every supporter, denoted by υ, has a preference for a game's quality, denoted by θ. For simplicity, we assume that these preferences are

[5] Note, it is not the gross salary x_k but the net-of-tax salary s_k that determines the playing talent, and, in turn, the win percentage.

uniformly distributed in $[0,1]$; that is, the measure of potential fans is 1.[6] The payoff for a supporter is described as the utility a supporter derives from attending a game, $\theta_v q_k$, minus the cost a supporter has to pay for it, p_k. We take for granted that a consumer's payoff cannot be negative, $\max\{\theta_v q_k - p_k, 0\}$. The consumer who is indifferent with respect to attending a game (or, similarly, paying a television fee to watch the game) is described by $\theta_v = \frac{p_k}{q_k}$. Thus, the number of supporters who are willing to attend a game at price p_k is expressed by $1 - \theta_v = \frac{q_k - p_k}{q_k}$.

By assuming that each club has a market size or drawing potential given by $m_k > 0$, the aggregate demand function for club k is denoted by

$$d_k(m_k, p_k, q_k) = m_k \frac{q_k - p_k}{q_k} = m_k(1 - \frac{p_k}{q_k}).$$

Thus, the club's revenue function is

$$R_k = p_k \cdot d_k(m_k, p_k, q_k).$$

The optimal choice for a club to maximize earnings is to set $p_k = \frac{q_k}{2}$, which results in the following revenue function:

$$R_k = \frac{m_k}{4} q_k = \frac{m_k}{4}(w_k(x_i, x_j) + CB(x_i, x_j) + \frac{1}{\sigma} AT(x_i, x_j)).$$

Our revenue functions differ from the revenue functions of other papers, i.e., Szymanski, 2003, Vrooman (2007, 2008) because our revenue function depends on consumer preferences for aggregagte talent. The revenue functions allow us to measure social welfare consisting of club profits, consumer surplus, supporter surplus, and player salaries.

Profit π_k for club k is given by revenues R_k minus gross salaries (salary payments) x_k

$$\pi_k = \frac{m_k}{4}(w_k(x_i, x_j) + CB(x_i, x_j) + \frac{1}{\sigma} AT(x_i, x_j)) - x_k.$$

Given that the maximal price consumers are willing to spend is $p_k = q_k$ and that in equilibrium, consumers have to pay a price of $p_k = \frac{q_k}{2}$, we receive

[6]For more detail, see H. Dietl, Lang, and Werner, 2009, and Falconieri, Palomino, and Sákovics, 2004, who use a similar approach.

the following aggregate consumer surplus (CS):

$$CS = CS_i + CS_j \text{ with } CS_k = \int_{\frac{q_k}{2}}^{q_k} m\frac{q_k - p_k}{q_k} dp_k = \frac{m}{8} q_k,\ k \in \{i, j\} \text{ so that}$$
$$CS = \frac{1}{8}(mq_i + q_j).$$

Net-of-tax player salary is given by $s_k = (1-\mu_k t)x_k = \alpha_k x_k$ and aggregate player salary by $PS = s_i + s_j$. We calculate aggregate club profits in the same way: $\pi_i + \pi_j$. The social planner receives $(1 - \alpha_i)x_i$ and $(1 - \alpha_j)x_j$ as taxes. With all four components social welfare is[7]

$$W(x_i, x_j) = \pi_i + \pi_j + CS + \alpha_i x_i + \alpha_j x_j + (1 - \alpha_i)x_i + (1 - \alpha_j)x_j,$$

With $\pi_i = R_i - x_i$ social welfare reduces to

$$W(x_i, x_j) = R_i + R_j + CS.$$

We have thus defined all our main variables: competitive balance, aggregate talent, club profit, consumer surplus, and social welfare. In the next section we calculate the equilibrium outcomes.

3. EQUILIBRIUM OUTCOMES

For notational simplicity, we normalize $m_j = 1$ and write $m_i = m$. To maximize profits, each club chooses the optimal salary payment x_k^*. Thus, the clubs' optimization problems are $max_{x_i \geq 0}\ \pi_i$ and $max_{x_j \geq 0}\ \pi_j$ with the corresponding first-order conditions

$$\frac{\partial \pi_i}{\partial x_i} = \frac{-4\sigma(x_i\alpha_i + x_j\alpha_j)^3 + m\alpha_i((x_i\alpha_i + x_j\alpha_j)^3 + 2x_j^2\alpha_j^2\sigma)}{\sigma(x_j\alpha_j + x_i\alpha_i)} = 0,$$
$$\frac{\partial \pi_j}{\partial x_j} = \frac{\alpha_j(x_i\alpha_i + x_j\alpha_j)^3 + 2\sigma(x_i^2\alpha_i^2\alpha_j - 2(x_i\alpha_i + x_j\alpha_j)^3)}{\sigma(x_j\alpha_j + x_i\alpha_i)} = 0,$$

and second-order conditions[8]

$$\frac{\partial \pi_i^2}{\partial x_i^2} = -\frac{3mx_j^2\alpha_i^2\alpha_j^2}{2(x_i\alpha_i + x_j\alpha_j)^4} < 0 \text{ and } \frac{\partial \pi_j^2}{\partial xj^2} = -\frac{3x_i^2\alpha_i^2\alpha_j^2}{2(x_i\alpha_i + x_j\alpha_j)^4} < 0.$$

[7] Note that $(1 - \alpha_k)x_k = \mu_k t x_k$.

[8] Second-order conditions for a maximum are satisfied because $\frac{\partial \pi_i^2}{\partial x_i^2} < 0$ and $\frac{\partial \pi_j^2}{\partial xj^2} < 0$.

From the first-order conditions, we derive the equilibrium salary payments

$$x_i^* = \frac{\alpha_i\alpha_j m^2\sigma(\alpha_j - 4\sigma)}{2(3m\alpha_i\alpha_j\sigma(\alpha_j - 4\sigma) - \alpha_j\sigma\beta + m\alpha_i\beta(\alpha_j - 3\sigma) - m^2\alpha_i^2(\alpha_j - 4\sigma)(\alpha j - \sigma)},$$
$$x_j^* = \frac{m\alpha_i(\alpha_j(m\alpha_i - 4\sigma)(\sigma(3m\alpha_i + \alpha_j) - m\alpha_i\alpha_j) + \beta(3\alpha_j\sigma + m\alpha_i(\sigma - \alpha_j))}{8\sigma^2(m\alpha_i - \alpha_j)^3},$$

with $\beta = (m\alpha_i\alpha_j(m\alpha_i - 4\sigma)(\alpha_j - 4\sigma))^{1/2}$. To ensure non-negative equilibrium salary payments, we assume from now on that the fan preference for aggregate talent is sufficiently large, with $\sigma < \sigma^* = \min\{\frac{\alpha_i m}{4}, \frac{\alpha_j}{4}\}$.

Next, we derive the equilibrium win percentages:

$$w_i^* = \frac{1}{1 + \frac{\alpha_j(4\sigma - m\alpha_i)}{(m\alpha_i\alpha_j(4\sigma - m\alpha_i)(\alpha_j - 4\sigma))^{1/2}}} \text{ and } w_j^* = \frac{1}{1 - \frac{m\alpha_i(\alpha_j - 4\sigma)}{(m\alpha_i\alpha_j(m\alpha_i - 4\sigma)(\alpha_j - 4\sigma))^{1/2}}}.$$

Club profits in equilibrium are

$$\pi_i^* = \frac{m^2(4\alpha_j\beta\sigma + m^2\alpha_i^2(6\alpha_j\sigma + 8\sigma^2 - 3\alpha_j^2) + m\alpha_i\alpha_j(2\sigma(5\alpha_j - 12\sigma) - 3\beta}{32\sigma^2(\alpha_j - m\alpha_i)^2},$$
$$\pi_j^* = \frac{2m\alpha_i\alpha_j\sigma(5m\alpha_i + 3\alpha_j) + 8\alpha_j\sigma^2(\alpha_j - 3m\alpha_i) - 3m^2\alpha_i^2\alpha_j^2 - 3m\alpha_i\alpha_j\beta + 4m\alpha_i\sigma\beta}{32\sigma^2(\alpha_j - m\alpha_i)^2}.$$

Consumer surplus in equilibrium is given by

$$CS_i^* = \frac{m(4\alpha_j\sigma\beta + m^2\alpha_i^2(6\alpha_j\sigma + 8\sigma^2 - 3\alpha_j^2)}{64\sigma^2(\alpha_j - m\alpha_i)^2} + \frac{m\alpha_i\alpha_j(2\sigma(5\alpha_j - 12\sigma) - 3\beta)}{64\sigma^2(\alpha_j - m\alpha_i)^2},$$
$$CS_j^* = \frac{2m\alpha_i\alpha_j\sigma(5m\alpha_i + 3\alpha_j) + 8\alpha_j\sigma^2(\alpha_j - 3m\alpha_i)}{64\sigma^2(\alpha_j - m\alpha_i)^2} + \frac{-3m^2\alpha_i^2\alpha_j^2 - 3m\alpha_i\alpha_j\beta + 4m\alpha_i\sigma\beta}{64\sigma^2(\alpha_j - m\alpha_i)^2}.$$

Consequently, social welfare in equilibrium is

$$\begin{aligned} W^* = & \frac{3m\alpha_i\alpha_j(3m\alpha_i(5 + m + m^2) + \alpha_j(9 + 5m(1 + 2m))}{64\sigma^2(\alpha_j - m\alpha_i)^2} \\ & + \frac{8\sigma^2(m^3\alpha_i^2(1 + 2m) - 3m\alpha_i\alpha_j(3 + m + m^2) + 3\alpha_j^2) - 3m^2\alpha_i^2\alpha_j^2(3 + m + 2m^2)}{64\sigma^2(\alpha_j - m\alpha_i)^2} \\ & + \frac{m\beta(9\alpha_i\alpha_j - 3m\alpha_i\alpha_j - 6m^2\alpha_i\alpha_j + 12\alpha_i\sigma + 4\alpha_j\sigma + 8m\alpha_j\sigma))}{64\sigma^2(\alpha_j - m\alpha_i)^2}. \end{aligned}$$

In the next section we examine the effect of a subsidy on the equilibrium outcomes.[9]

4. EFFECTS OF SUBSIDIES ON EQUILIBRIUM OUTCOMES

In this section we discuss the implications of our results step by step. First, we explore the consequences of a subsidy $\alpha_i \in (\alpha_j, \alpha_i^*)$ for club i on its salary payments.[10]

Proposition 1 *Suppose club i receives a subsidy. Increasing the subsidy always increases the salary payments of club i, while it increases the salary payments of club j if and only if the subsidy is not too large. Otherwise, a subsidy for club i reduces salary payments of club j. Formally,* $\frac{\partial x_i}{\partial \alpha_i} > 0$ $\forall \alpha_i \in (\alpha_j, 1)$ *and* $\frac{\partial xj}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i \in (\alpha_j, \alpha_i^*)$ *with* $\alpha_i^* = \frac{16\alpha_j\sigma}{m(3\alpha_j+4\sigma)}$.

Proof. See Appendix

To explain Proposition 1, we use Figure 1, which displays subsidies on the x-axis and salary payments on the y-axis. The dotted line denotes the large club. The solid line denotes the small club. Panel A shows the case when a large club receives a subsidy. Panel B shows the case when a small club receives a subsidy.

A club's profit depends on its win percentage, competitive balance, and aggregate talent. When a club receives a subsidy, it will always invest it. If the club, which does not receive a subsidy, is small, it mainly benefits from aggregate talent. As competitive balance decreases the small club cannot profit from it. If the club, which does not receive a subsidy, is large, it can benefit from both aggregate talent and competitive balance.

On the left side of Figure 1, both clubs invest in salary until the subsidy reaches a limit. Once the subsidy reaches a limit only the large club invests in salary. The small club decreases investment in salary.

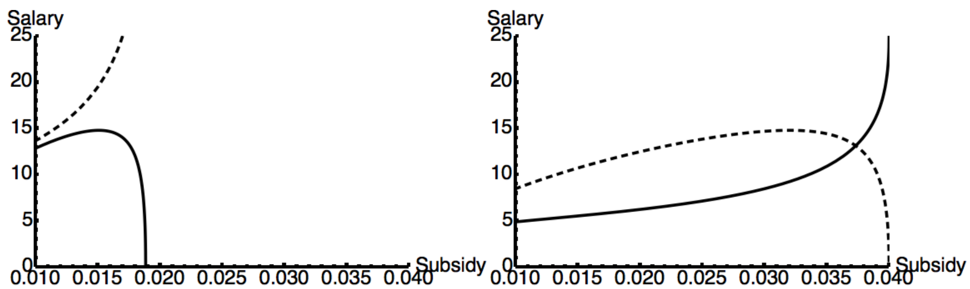
As shown on the right side of Figure 1, the salary investment of the large club, which does not receive the subsidy, first increase and then decrease. The salary investment for the small club increases. In both cases (left and

[9] A benchmark case (when the tax subsidy is symmetric) does not yield different results compared with no subsidies.

[10] An equivalent proposition can be derived if club j receives the tax break.

Figure 1 - Salary Payments

Panel A: Subsidy for large club Panel B: Subsidy for small club



——— Small club - - - - - Large club

right side in Figure 1) the salary payments for the subsidy receiving club always increase.

The following proposition analyzes the effect of subsidies on win percentage.

Proposition 2 *Suppose club i receives a subsidy. Increasing the subsidy always increases the win percentage of club i and decreases the win percentage of club j. Formally,* $\frac{\partial w_i}{\partial \alpha_i} > 0$ *and* $f\frac{\partial w_j}{\partial \alpha_i} < 0 \ \forall \alpha_i \in (\alpha_j, 1)$.

Proof. See Appendix

The proposition shows that a higher subsidy has an unambiguous effect on win percentages. Thus, even if club j increases salary payments as a result of a subsidy lower than the subsidy of club i, this increase is overcompensated for by an increase in the salary payments of club i.

Next, we examine the effect of subsidies on competitive balance.

Proposition 3 *Suppose club i receives a subsidy. If club i is the large club, increasing the subsidy always decreases competitive balance. If club i is the small club, increasing the subsidy increases competitive balance if and only if the subsidy is not too large. Otherwise, a subsidy for the small club de-*

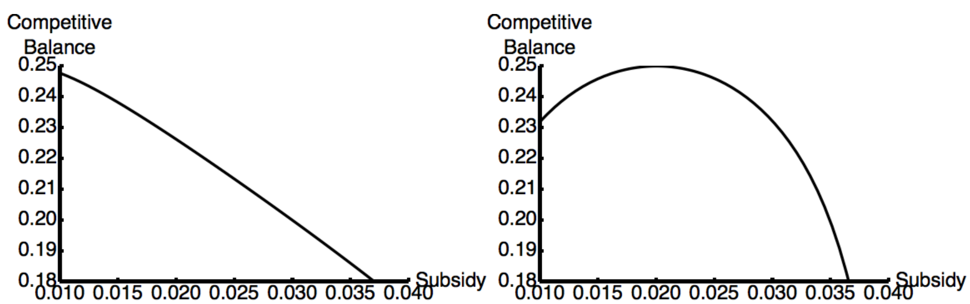
creases competitive balance. Formally, $\frac{\partial CB}{\partial \alpha_i} < 0 \ \forall \alpha_i \in (\alpha_j, 1)$ *for* $m > 1$ *and* $\frac{\partial CB}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i \in (\alpha_j, \alpha_i^{CB})$ *with* $\alpha_i^{CB} = \frac{\alpha_j}{m}$ *for* $m < 1$.

Proof. See Appendix

To explain Proposition 3, we use Figure 2, which displays competitive balance.

Figure 2 - Competitive Balance

Panel A: Subsidy for large club Panel B: Subsidy for small club



The effect of a subsidy on competitive balance depends on which club receives the subsidy. If one club dominates the league, competitive balance is comparably low. When a (small or large) club benefits from a subsidy, the club's salary payments will increase as the club has more funds available. If the large club receives a subsidy, competitive balance will decrease as the large club's salary payments further increase in relation to the salary payment of the small club. The opposite holds true for the small club: An increasing subsidy leads to higher salary payments of the small club, resulting in a more balanced league until a maximum. After the maximum, competitive balance decreases. Figure 2 shows this case on the right-hand side. Additionally, a relatively high preference for aggregate talent leads to lower (higher) competitive balance if the large (small) market club receives a subsidy.

We derive the following numerical result for the effect of a subsidy on aggregate talent:

Result 1 *Suppose club i receives a subsidy. Increasing the subsidy always increases aggregate talent in the league if and only if the subsidy is not too large. Otherwise, a subsidy for club i reduces aggregate talent. Formally,* $\frac{\partial AT}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i \in (\alpha_j, \alpha_i^{AT})$.

Proof. See Appendix.

If club i receives a subsidy, it will increase its salary payments. If the subsidy does not exceed a certain threshold (see previous result), club j will have positive salary payments as well. Club j also benefits from the subsidy through the increase in aggregate talent. However, if the subsidy is too large, club j will considerably decrease its salary payments. The additional salary payments of club i will then be lower than the decrease in salary payments of club j. Therefore, aggregate talent decreases. In the next result, we analyze how a subsidy affects club profits.

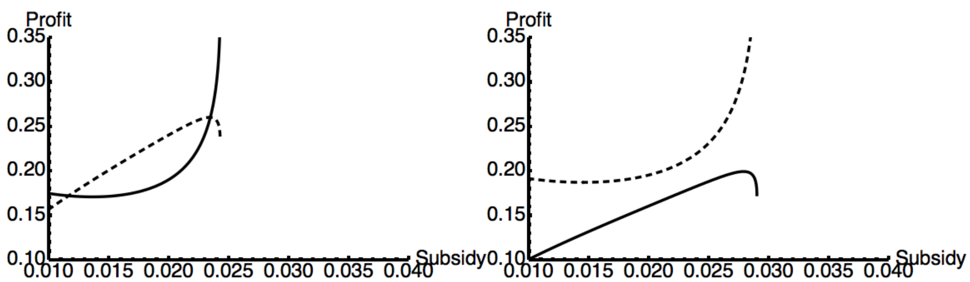
Result 2 *Suppose club i receives a subsidy. Increasing the subsidy increases the profits of club i if and only if the subsidy is not too large. The opposite is true for club j: increasing the subsidy for club i increases the profits of club j if and only if the subsidy is sufficiently large. Formally,* $\frac{\partial \pi_i}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i \in (\alpha_j, \alpha_i^{\pi})$ *and* $\frac{\partial \pi j}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i \in (\alpha_j^{\pi}, 1)$.

Proof. See Appendix.

To explain Result 2, we use Figure 3, which displays subsidies on the x-axis and club profits on the y-axis. The dotted line denotes the large club. The solid line denotes the small club. Panel A shows the case when a large club receives a subsidy. Panel B shows the case when a small club receives a subsidy.

Figure 3 - Club Profits

Panel A: Subsidy for large club   Panel B: Subsidy for small club



——— Small club   - - - - - Large club

In panel A we see the case when the large club receives a subsidy leading to an increase in salary payments. Accordingly, this increase leads to a more unbalanced league (effect on competitive balance). Nevertheless, the small club benefits from the increase of salary payments because of an increase in aggregate talent.

In panel B we see the case when the small club receives a subsidy. The subsidy will lead to an increase in salary payments. A small subsidy leads to an increase in competitive balance while a large subsidy leads to a decrease in competitive balance. Aggregate talent increases for both a large and small subsidy and almost always has a positive effect on revenues. The small club's increase in salary payments is smaller than the decrease in the large club's salary payments. We see in panel B that a very large subsidy decreases the profit of the small club (see Appendix for proof).

Next, we examine the effect of subsidies on social welfare. We derive the following numerical finding:

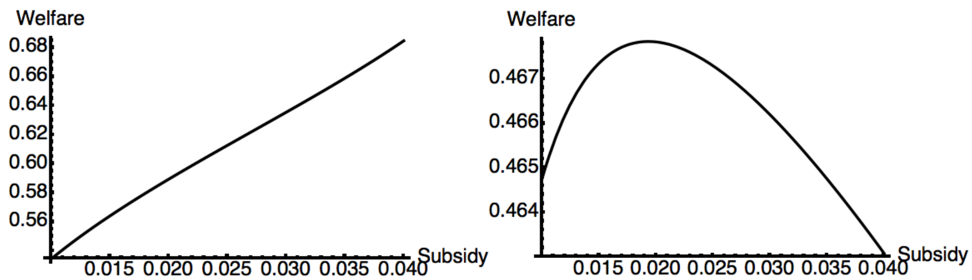
Result 3 *Suppose club i receives a subsidy.*
(a) If supporters have a high preference for aggregate talent, increasing the subsidy always increases social welfare (see left panel of Figure 4), i.e., $\frac{\partial W}{\partial \alpha_i} > 0 \; \forall \alpha_i \in (\alpha_j, 1)$ *for* $\sigma < \sigma^*$.
(b) If supporters have a low preference for aggregate talent, increasing the subsidy increases social welfare if and only if the subsidy is not too large, i.e., $\frac{\partial W}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i \in (\alpha_j, \alpha_i^W)$ *for* $\sigma > \sigma^*$.

Proof. See Appendix.

To explain Result 3, we use Figure 4, which displays subsidies on the x-axis and social welfare on the y-axis. Panel A shows the case when supporters have a high preference for aggregate talent (thus $\frac{1}{4} \leq \sigma \leq \frac{1}{2}$). Panel B shows the case when supporters' preference for aggregate talent is comparatively small (i.e., $\frac{1}{4} < \sigma$).

Figure 4 - Social Welfare

Panel A: High preference for talent   Panel B: Low preference for talent



Panel A shows that aggregate talent (almost) always increases through higher subsidy (kink in aggregate talent seems not to have an effect, see Figure 5 in the Appendix). If preference for aggregate talent is sufficiently high, then this effect dominates all other effects. Panel B shows that the social planner must be more careful when setting the subsidy if supporters have a low preference for aggregate talent. This means that competitive balance is more important for the generation of revenues. In this case, social welfare first increases as the subsidy increases until a maximum level is reached. Increasing the subsidy beyond this optimum level leads to a reduction in social welfare. To clarify the results from the previous proofs all effects are summarized in table 1.

Table 1 - Results overview

	Subsidy for large-market, effect on		Subsidy for small-market, effect on	
	large-market	small-market	large-market	small-market
Salary payments	+	ambiguous	ambiguous	+
Win percentage	+	-	-	+
Competitive Balance	-		ambiguous	
Aggregate talent	ambiguous		ambiguous	
Club profits	+	ambiguous	ambiguous	ambiguous
Social welfare	ambiguous		ambiguous	

POLICY IMPLICATIONS

Four parts of our model are especially interesting for policy makers: competitive balance, aggregate talent, club profit, and social welfare.

We show that competitive balance significantly changes when one club receives a subsidy. When a large-market club receives a subsidy, competitive balance decreases. When a small-market club receives a subsidy, competitive balance first increases but decreases when the subsidy is too large. Thus, when a policy maker wants to set the socially optimal competitive balance, he has to limit the amount of the subsidy that a small market club receives.

Managing the amount of a subsidy is an effective policy instrument to influence aggregate talent in a league. Increasing the amount of the subsidy increases aggregate talent until a maximum is reached. Increasing the subsidy above this talent-maximizing level decreases aggregate talent in the league. Thus, it is important for the policy maker to find the optimal amount of the subsidy to maximize aggregate talent in a league.

Club profit depends on win percentage, competitive balance, and aggregate talent. We describe for policy makers two situations regarding club profits. One scenario is when fans have a low preference for aggregate talent. Then, aggregate club profit increases only when competitive balance increases. This means that the small market club should be subsidized. The second scenario is when fans have a high preference for aggregate talent. Then, aggregate club profit increases only if the large club receives a subsidy. Thus, it is important for a policy maker to identify whether fans have a high or low preference for aggregate talent.

Aggregate club profits increase when the large-market club receives the subsidy and fans have a low preference for aggregate talent. When the small market club receives the subsidy, aggregate club profits decrease. When fans have a high preference for aggregate talent then a subsidy for the large-market club increases aggregate profit. However, a subsidy for the small-market club first increases aggregate profit but when the subsidy is too large, aggregate profit decreases.

We assume that a policy maker is mainly interested to increase win percentage and tax revenues in the decision making process. A subsidy for a large-market share club always decreases competitive balance while a subsidy for a small-market share club has ambiguous effects. The subsidy for the small-market club results in higher salary payments which ultimately effect the win percentage of both clubs. When a maximum is reached (i.e., a balanced league), further increasing the subsidy decreases competitive balance.

Our model provides essential policy implications regarding social welfare. While common intuition says that a subsidy is only beneficial for the subsidy receiving club, our model shows that a different interpretation is appropriate. When supporters from both clubs have a high preference for aggregate talent, both clubs can benefit in terms of profit. However, when supporters have a low preference for aggregate talent, social welfare depends mainly on competitive balance and win percentage. Thus, when a subsidy results in a more unbalanced league, social welfare decreases.

CONCLUSION

The aim of this article is to develop a game-theoretic model that analyzes how subsidies influence a professional team sports league. In addition to win percentage and competitive balance, the model includes fan preference for aggregate talent. The paper examines how subsidies influence salary payments, competitive balance, club profits, and social welfare.

Future research can weigh competitive balance, win percentage, and aggregate talent differently. Additionally a similar setting in a league where clubs are win or utility maximizers can yield interesting results.

Appendix

Proof of Proposition 1

To proof the claim in Proposition 1, we proceed as follows. First, we show that the subsidy always increases the salary payments of club i if this club receives a subsidy, i.e., $\frac{\partial x_i^*}{\partial \alpha_i^*} > 0 \; \forall \alpha_i > \alpha_j$. We compute

$$\begin{aligned}
\frac{\partial x_i^*}{\partial \alpha_i} &= 0 \Leftrightarrow \alpha = \{\alpha_1, \alpha_2\} \text{ with} \\
\alpha_{i1} &= -\frac{m(\alpha_j - 2\sigma) + (m(\alpha_j - 4\sigma)(\alpha_j - \sigma))^{1/2}}{m^2} \\
\alpha_{i2} &= \frac{-m(\alpha_j - 2\sigma) + (m(\alpha_j - 4\sigma)(\alpha_j - \sigma))^{1/2}}{m^2}
\end{aligned}$$

We have $\alpha_i < 0$ and $\alpha_j > 1$. Moreover, $\frac{\partial x_i^*}{\partial \alpha_i} > 0 \Leftrightarrow \alpha \in (\alpha_i, \alpha_j)$. Thus, we conclude that $\frac{\partial x_i^*}{\partial \alpha_i^*} > 0 \; \forall \alpha_i \in (\alpha_j, 1)$, which proves the claim.

Second, we show that subsidy for club i increases the salary payments of club j if and only if the subsidy is not too large, i.e., $\frac{\partial x_j^*}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i < \alpha_i^* = \frac{16\alpha_j\sigma}{m(3\alpha_j + 4\sigma)}$. We compute

$$\frac{\partial x_j^*}{\partial \alpha_i} = 0 \Leftrightarrow \alpha = \alpha_i^* = \frac{16\alpha_j\sigma}{m(3\alpha_j + 4\sigma)}.$$

Moreover, we derive $\lim_{\alpha_i \to 0} \frac{\partial x_j^*}{\partial \alpha_i} = \frac{m}{2\alpha_j} > 0$ and thus $\frac{\partial x_j^*}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i < \alpha_i^*$, which proves the claim.

Proof of Proposition 2

Competitive balance is defined as

$$CB(x_i, x_j) = w_i(x_i, x_j)w_j(x_i, x_j) = \frac{\alpha_i x_i \alpha_j x_j}{(\alpha_i x_i + \alpha_j x_j)^2}.$$

so that competitive balance in an equilibrium is

$$CB^* = \frac{1}{(1 - (\frac{m\alpha_i(\alpha_j - 4\sigma)}{\sqrt{m\alpha_i\alpha_j(m\alpha_j - 4\sigma)(\alpha_j - 4\sigma)}})(1 + (\frac{\alpha_j(4\sigma - m\alpha_i)}{\sqrt{m\alpha_i\alpha_j(m\alpha_i - 4\sigma)(\alpha_j - 4\sigma)}})}.$$

Recall that large values of CB characterize a more balanced league. The most balanced league - a league with two equally strong clubs - has a maximum value of 0.25.

Next, we compute

$$\frac{\partial CB^*}{\partial \alpha_i^*} > 0 \Leftrightarrow \alpha_i < \alpha_i^{CB} = \frac{\alpha_j}{m}.$$

Note that $\alpha_i^{CB} < \alpha_j$ for $m > 1$ and $\alpha_i^{CB} > \alpha_j$ for $m < 1$.

(a) Suppose that club i is the large club with $m > 1$ so that $\alpha_i^{CB} < \alpha_j$. Given that club i receives the subsidy, it holds $\alpha_i > \alpha_j$ and thus $\alpha_i > \alpha_i^{CB}$. We conclude that $\frac{\partial CB^*}{\partial \alpha_i^*} < 0 \ \forall \alpha_i \in (\alpha_j, 1)$, i.e., competitive balance in the league decreases.

(b) Suppose that club i is the small club with $m < 1$ so that $\alpha_i^{CB} > \alpha_j$. Given that club i receives the subsidy, it holds $\alpha_i > \alpha_j$ and thus by increasing the subsidy the league becomes more balanced for all $\alpha_i \in (\alpha_j, \alpha_i^{CB})$ and less balanced for all $\alpha_i \in (\alpha_i^{CB}, 1)$. Formally, $\frac{\partial CB}{\partial \alpha_i} > 0$ if $\alpha_i < \alpha_i^{CB}$ and $\frac{\partial CB}{\partial \alpha_i} < 0$ if $\alpha_i > \alpha_i^{CB}$. This completes the proof of Proposition 2.

Proof of Proposition 3

To show that a subsidy for club i always increase the win percentage of club i and decreases the win percentage of club j, we proceed as follows. We derive

$$\frac{\partial w_i^*}{\partial \alpha_i} = \frac{2\alpha_j \sigma \gamma}{\alpha_i \left(-m\alpha_i\alpha_j + 4\alpha_j\sigma + \gamma\right)^2},$$
$$\frac{\partial w_j^*}{\partial \alpha_i} = -\frac{2m^2\alpha_i\alpha_j\sigma(\alpha_j - 4\sigma)^2}{\gamma\left(-m\alpha_i(\alpha_j - 4\sigma) + \gamma\right)^2},$$

with $\gamma = \sqrt{m\alpha_i\alpha_j(m\alpha_i - 4\sigma)(\alpha_j - 4\sigma)}$.So that $m\alpha_i\alpha_j(m\alpha_i - 4)(\alpha_j - 4) > 0$. It is straightforward to show that $\frac{\partial w_i^*}{\partial \alpha_i} > 0$ and $\frac{\partial w_j^*}{\partial \alpha_i} < 0 \ \forall \alpha_i \in (\alpha_j, 1)$.

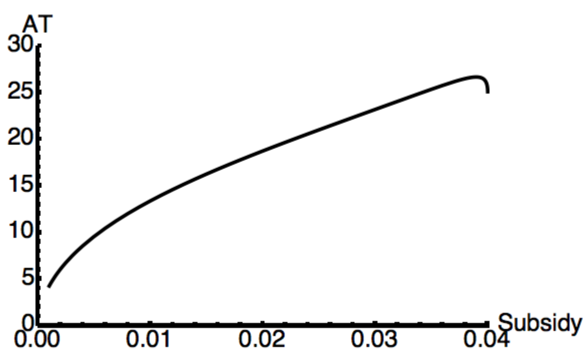
Proof of Result 1

To prove the claim of Result 1, we have to rely on numerical simulations. We set $m = 0.5; \alpha_j = 0.01; \sigma = 0.5$. Solving the maximization problem

$\max_{\alpha_i \in (\alpha_j,1)}(x_i^* + x_j^*)$ yields $\alpha_i^{AT} = 0.038$ and thus $\frac{\partial x_i^* + x_j^*}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i \in (\alpha_j, \alpha_i^{AT})$. Thus, a higher subsidy for club i always increases aggregate talent in the league if and only if the subsidy is not too large. This completes the proof of Result 1.

To explain Proof of Result 1, we use Figure 5 that displays subsidies on the x-axis and aggregate talent on the y-axis.

Figure 5 - Aggregate Talent



Proof of Result 2

To prove the claim of Result 2, we have to rely on numerical simulations again. We set $m = 0.5; \alpha_j = 0.01; \sigma = 0.5$: (i) Solving the maximization problem $\max_{\alpha_i \in (\alpha_j,1)} \pi_i^*$ yields $\alpha_i^\pi = 0.038$ and thus $\frac{\partial \pi_i}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i \in (\alpha_j, \alpha_i^\pi)$. (ii) Solving the minimization problem $\min \pi_j^*$ yields $\alpha_j^\pi = 0.02$ and thus $\frac{\partial \pi j}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i \in (\alpha_j^\pi, 1)$. Thus, part (i) shows that a higher subsidy for club i always increases the profits of club i if and only if the subsidy is not too large. Part (ii) shows that a higher subsidy for club i increases the profits of the other club j if and only if the subsidy is sufficiently large,

Proof of Result 3

To prove the claims of Result 3, we have to rely on numerical simulations again. We set $m = 0.5; \alpha_j = 0.01; \sigma = 0.5$. The maximization problem $\max_{\alpha_i \in (\alpha_j, 1)} W^*$ has no interior solution and thus $\frac{\partial W}{\partial \alpha_i} > 0 \; \forall \alpha_i \in (\alpha_j, 1)$ for $\sigma < \sigma^*$. Thus, increasing the subsidy always increases social welfare if supporters have a high preference for aggregate talent.

Second, we set $m = 0.5; \alpha_j = 0.01; \sigma = 2$. Solving the maximization problem $\max_{\alpha_i \in (\alpha_j, 1)} W^*$ yields $\alpha_i^W = 0.015$ and thus $\frac{\partial W}{\partial \alpha_i} > 0 \Leftrightarrow \alpha_i \in (\alpha_j, \alpha_i^W)$ for $\sigma > \sigma^*$. Thus, if supporters have a low preference for aggregate talent, increasing the subsidy increases social welfare if and only if the subsidy is not too large.

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MOMENTUM IN TENNIS: CONTROLLING THE MATCH

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Although many studies examine if players in sports and especially in tennis benefit from a psychological or physiological boost (momentum) none examine whether the set score or tournament rounds are important determinants when assessing momentum. We empirically investigate when professional female and male tennis players benefit from momentum. In contrast to previous work, we find players benefit from momentum as long as they control a match. Once players lose control over a match, they have a significantly lower chance to win the next set than their opponent. This loss of control results in what we call anti-momentum.

1. INTRODUCTION

The physical concept of momentum is defined as mass times velocity. Momentum is not only interesting for physicists but also for researchers in areas such as, finance, management, psychology, and economics.

In sports psychology, researches examine momentum because they want to know if a player outperforms at one point in a match. If momentum is tangible then players, coaches, and managers have a genuine advantage to exploit. Benefiting from momentum could give a player the final component to win a decisive match. Additionally, bettors can use knowledge about momentum to gain from favorable bets. Hence, betting companies have a similar interest in momentum to avoid unfavorable odds. Momentum is also important for tournament organizers. In order to structure a tournament which maximizes revenue and/or excitement, tournament organizers have an interest to set matches to maximize fan interest.

In this paper, we empirically investigate when professional female and male tennis players benefit from momentum.

Momentum means that a player benefits from a psychological and/or physiological boost. A psychological boost is a positive change in cognition. Cognition includes changes in self-efficacy, motivation, and attention. A physiological boost is a positive change in behavior. Behavior includes activity level, pace, posture, or frequency. Our definition is in line with previous definitions of momentum in sports (see the multidimensional model of momentum by Taylor & Demick, 1994). Therefore, we use the concept of momentum, which includes both psychological and physiological effects.

Psychologists use momentum to describe a competitive situation between two individuals (psychological momentum) (Iso-Ahola and Mobily, 1980). In such a competitive situation, one person uses psychological warfare to improve his own situation. Psychological momentum is the result of successful psychological warfare. Iso-Ahola and Mobily (1980, p. 391) describe psychological momentum: " . . . it increases the person's perceived probability of success by modifying his and the opponent's perceptions and impressions of one another." This definition fits perfectly to a sports environment. In sports competition between individuals or teams is essential. One of the first research papers in psychological momentum by Gilovich, Vallone, and Tversky (1985) received widespread attention. The authors examine the so called "hot hand" for basketball players. They define a hot hand as the "performance of a [basketball] player during a particular period [which] is significantly better than expected on the basis of the player's overall record." (Gilovich et al., 1985, p. 295-296) This means that a player who is significantly better than expected based on his overall record benefits from psychological momentum. In the context of basketball, Gilovich et al. define momentum by the shooting accuracy of a player. They examine shooting records of the Philadelphia 76ers, free-throw records of the Boston Celtics, and shooting records of varsity players from Cornell University. They empirically examine if a high shooting accuracy is stable throughout a game. They conclude that basketball players do not increase their probability to hit with every consecutive shot. Thus, a hot hand, or momentum, does not exist.

Their results initiated widespread discussion among researchers. Wardrop (1995) criticized Gilovich et al.'s research methods. He asserts that Gilovich et al.'s results suffer from the Simpson paradox, which states that if a trend appears in different data groups the trend can disappear when the groups are combined. Wardrop claims that Gilovich et al. incorrectly combine groups in their analysis, therefore their data analysis yields incorrect results. Burns (2001) argues, that Gilovich et al. need the performance data of every team player to test for the improved performance of an individual. Gilovich et al. however, observe only individual performance. Bar-Eli, Avugos, and Raab (2006) examine how research on the hot hand has evolved and what results it provides. Aggregating the research on the hot hand they find no clear indicator of its existence. In a recent paper by Csapo, Avugos, Raab, and Bar-Eli (2015) the authors examine that players face increased competition when they outperform. Thus, in order to measure momentum, researchers should correct for the increased amount of competition. These papers show that in team sports and especially in basketball, the existence of psychological momentum is widely disputed. In contrast to team sports, individual sports (e.g. tennis and racquetball), provide a competitive situation where momentum is more easily visible. In these sports, opponents directly influence each other. Thus, no intermediates (e.g. other team members) bias the results. Tennis is a good individual sport to study because most matches are played one-on-one procedure. This one-on-one situation is especially interesting for research in sports momentum because research in team sports is influenced by several opponents and members from the own team.

In tennis, momentum is empirically examined by observing if the player who won the second to last set has a significant advantage in the last set. In a best-of-three set match this means that both players have won one set. Researchers then observe who wins the last set. This concept is similar to the concept of comeback.

Clearly, the hot hand in basketball is not the same as momentum in tennis. However, both concepts rely on the notion that players have a psychological or physiological advantage at one point in a match.

Several authors have already examined momentum in tennis. Silva, Hardy, and Crace (1986) observe intercollegiate tennis. They do not find evidence for psychological momentum for best-of-three set matches. Thus, Silva et al. observe if the player who was down one set benefits from a comeback. Weinberg and Jackson (1989) examine a vast dataset of professional and amateur tennis players. They observe the comeback behavior of men and women after losing the first of three sets. They find that men are more likely to win a "comeback game" than women. Burke, Edwards, Weigand, and Weinberg (1997) ask tennis players to assess when they observe momentum. They find that tennis players disagree when a player benefits from momentum. Malueg and Yates (2010) use betting odds to control for a player's skill set when examining best-of-three set matches. They find that the effort invested in the first set is an important indicator to forecast which player wins the third set.

Our analysis differs in two ways from previous work in the area of momentum.

Our first difference is that we examine the set score. We analyze whether the set score has an effect on momentum. Earlier studies (cf., Silva et al., 1986; Richardson, Adler, & Hankes, 1988; Weinberg & Jackson, 1989) analyze only whether a player wins or loses (i.e. win=1, lose=0) a set. Henceforth, this method is called the binary approach. A drawback to using the binary approach, is that it does not distinguish if a player wins a set 6 - 0 or 7 - 6. Reducing the outcome of a decisive set to a binary variable does not exploit all relevant information within the data, therefore we include the set score in our data analysis.

Our second point of departure is that we check if momentum depends on the rounds in a tournament. We want to analyze whether momentum increases or decreases for a player depending on the round he plays. The intuition is that players might perform differently in a final round compared to a first round; we might observe different momentum levels. We find that momentum does not depend on the round; no difference exists between a final match or a first round match.

In contrast to earlier studies, our results show that momentum depends on the set score. We find that winning the second to last set with a high margin significantly increases the chances to win the last set. On the other hand, if a player barely wins the second to last set he is likely to lose the last set and, therefore, the entire match. We call this phenomenon anti-momentum. Anti-momentum is the result of a perceived loss of control. A player who barely won the second to last set, after being ahead in the match, feels that he is losing control of the match. Whereas a player who easily won the second to last set after being behind in the match feels that he has (re-) gained control of the match. Our paper is structured as follows: Section 2 gives a general explanation of tennis rules. Section 3 presents our data. Section 4 evaluates the data and Section 5 is a brief conclusion of our findings.

2. TENNIS RULES

Tennis is played in a one on one game (singles) or in a two on two game (doubles). There are tournaments for men's singles, men's doubles, women's singles, women's doubles, and mixed doubles.

Tennis is structured in this way: points form a game, games form a set, and sets form a match. A game is not the same as a match. A player wins a game if he wins at least four points and two more than his opponent. A set is complete if one player wins at least six games and wins two more games than his opponent. In some Grand Slam tournaments a player has to win two more games than his opponent to win the last and/or decisive set. However, in the second to last set a tie break is played. When the score is 6 - 6 a set is decided by a tie break. The outcome of the set is won by the player who has scored at least seven points and two more points than his opponent.

If one player has won five games, then the opponent needs at least seven games to win the set. Matches are played in best-of-three sets or best-of-five sets mode. Women always play best-of-three set matches, men also play best-of-five set matches. The player who wins two (respectively three) sets wins the match.

Tennis tournaments give different amounts of points. Winning the final in the highest ranked tournament gives 2,000 points (Grand Slam), 1,500 points in the second highest ranked tournament (ATP World Tour Final), and 1,000 points in the third highest ranked tournament (ATP 1,000 Tournaments). Players who do not win a tournament receive a share of the points based on their success in the respective tournament.[1]

A player is ranked based on the points he gathers in all ATP or Grand Slam tournaments in the previous twelve months. The ranking ". . . is the ATP's historical objective merit-based method used for determining entry and seeding in all tournaments for both singles and doubles, except as modified for the Barclays ATP World Tour Finals." (Association of Tennis Professionals, 2015)

3. METHOD

Data

We use data for all Grand Slam tournaments beginning with 1985 for men and 2003 for women. This is due to the availability of complete data. Otherwise we would have included the same time frame for both men and women. Our analysis includes the Australian Open, Roland Garros, US Open, and Wimbledon. Table 1 gives an overview of all variables. We include only matches

[1] For example in a Grand Slam tournament, the runner up receives 1,200 points, a semi-finalist 720 points and so on.

played until the last point (we do not include matches where a player resigns). If a male player needs three or four sets to win (respectively, a female player needs two sets to win), the respective match is omitted from our dataset because we cannot determine a certain set or outcome in these matches to measure momentum. This is only possible for best-of-five-set matches for men and best-of-three-set matches for women. Due to this process a large part of the matches are omitted (we keep approximately 4,200 matches from a total of approximately 19,000 matches.).

We include the winner and the loser of a match. Because the data provides the nationality of both players, we add a variable to control how players benefit from a home advantage. Therefore, we differentiate between players from Australia, France, United Kingdom, and USA the venues for the Grand Slam tournaments. Similar approaches are applied by Koning (2011) and Krumer, Rosenboim, and Shapir (2014).

Additionally, we add the number of sets a player played in the previous match in the same tournament. For a Grand Slam tournament a previous match has either three, four, or five sets for men and two or three sets for women. The intuition is that a player is tired after playing five sets in the previous round. If a player has not played in the previous match (e.g., in the first round) we categorize the player as not tired. This means a player has a "0" in all previous match categories.

Table 1: Summary statistics.

Variable	**Min.**	**Max.**	**N**
Year	1985	2013	29
Log rank difference	-5.937	4.863	4,283
Set outcome: 6 - 0	0	1	124
Set outcome: 6 - 1	0	1	420
Set outcome: 6 - 2	0	1	619
Set outcome: 6 - 3	0	1	1,024
Set outcome: 6 - 4	0	1	1,009
Set outcome: 6 - 5	0	1	461
Set outcome: 7 - 6	0	1	709
Male - 3 sets previous match	0	1	638
Male - 4 sets previous match	0	1	442
Male - 5 sets previous match	0	1	259
Female - 2 sets previous match	0	1	259
Female - 3 sets previous match	0	1	269
Female	0	1	1,644
Male	0	1	2,722
Home advantage	0	1	417
Roland Garros	0	1	1,093
US Open	0	1	1,057
Wimbledon	0	1	1,136
Australian Open	0	1	1,080
Round 1	0	1	2,233
Round 2	0	1	1,063
Round 3	0	1	529
Round 4	0	1	287
Quarterfinal	0	1	142
Semifinal	0	1	80
Final	0	1	32

We distinguish between the rounds. A Grand Slam tournament has seven stages: 1st round, 2nd round, 3rd round, 4th round, quarterfinal, semifinal, and final. The effort level between rounds could vary because players receive a higher compensation the further they advance in a tournament. Players could invest more effort for higher paying tournaments, however, for all tournaments in our data set the players receive the same number of points.

Table 2: Summary statistics.

Set score	**6 - 0**	**6 - 1**	**6 - 2**	**6 - 3**	**6 - 4**	**6 - 5**	**7 - 6**	**N**
Round 1	.687	.650	.582	.530	.510	.508	.479	2,233
Round 2	.655	.623	.549	.586	.457	.627	.465	1,063
Round 3	.786	.55	.707	.583	.481	.673	.469	539
Round 4	.5	.423	.547	.562	.603	.558	.471	287
Quarterfinal	.833	.714	.455	.526	142	.471	.461	142
Semifinal	1	.625	.615	.611	.461	.7	.529	80
Final		.75	0	.384	.75	0	.4	32

Table 2 provides a concise overview of this data. The table shows the score of the second to last set in every round. For example 68.7% of all players won the match in the first round when the won the second to last set 6-0.

Additionally, the tournament type yields information about the playing surface. The surface in Wimbledon is grass; at the French Open clay; and at the Australian and US Open hard. It is possible that the different surface types influence the results of our analysis. For a more advanced discussion about the impact of the surface in tennis see for example Gilsdorf and Sukhatme(2008) or del Corral (2009). We add tournament type as a fixed effects component in the analysis.

We use the points a player has received immediately before the tournament starts. We generate a variable that measures the different amassed points of the players who face each other. Tennis players are ranked based on the amount of points they gathered in the previous twelve months (as explained in the previous section). We use the log of the rank of the winner of a match minus the log of the rank of the runner-up (cf., Koning, 2001). The difference in points controls for the players skill sets.

All variables, except for the log of ranking and the set outcome, are dummy variables.

4. DATA ANALYSIS - CLASSICAL BINARY APPROACH

Table 3 shows the results when using the binary approach. The dependent variable is "1" if a player won the last set, and "0" if the player lost the last set. Throughout this paper we use the same dependent variable. We include all control variables mentioned in the previous section. This approach, except for the introduction of the control variables, is similar to the approach used by Silva et al. (1986), Richardson et al. (1988) and Weinberg and Jackson (1989). In the binary approach a player either wins or loses the second to last set. The set outcome is omitted when using the binary approach. That means a 6 - 0 or a 7 - 6 are both a "1" for the winner and "0" for the runner-up. By using this approach a significant amount of data is lost. Because the dependent variable is binary, one can also use a probit model; however, the additional value of the probit model in this context is not clear. For a more detailed discussion of the advantages and disadvantages of a probit model see Angrist (2001) or Beck (2011). We performed the same analysis with a probit regression and did not receive statistically significant different results.

We use ordinary least squares with robust standard errors. Round 1 and Round 2 are omitted in every regression because of collinearity issues with Round 3. This means, that the results from round 1, round 2, and round 3 are too similar to include all in our analysis. Accordingly, we omit both round 1 and round 2.

Table 3: Binary approach.

Binary set score	
Round 3	0.0299
	(0.0265)
Round 4	0.00102
	(0.0335)
Quarterfinal	-0.0247
	(0.0450)
Semifinal	0.0428
	(0.0580)
Final	-0.119
	(0.0910)
Ranking	-0.00106
	(0.00526)
3 sets previous match male	0.0185
	(0.0264)
4 sets previous match male	0.0104
	(0.0295)
5 sets previous match male	0.0130
	(0.0356)
2 sets previous match female	-0.0228
	(0.0369)
3 sets previous match female	-0.0170
	(0.0304)
Female	-0.00919
	(0.0221)
Home advantage	-0.0224
	(0.0267)
FE Tournament	Y
Constant	0.542***
	(0.0194)
Observations	4,268
R-squared	0.002

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

Table 3 shows that players have a 54.2% chance to win the last set when they win the second to last set (assuming that all variables are "0"). Rounds, home advantage, gender difference, and previous matches for females have no statistically significant effect on the outcome in both Table 3 and 3.

DATA ANALYSIS - SET SCORE APPROACH

In Table 4 we analyze the data from a different perspective. To examine the set score of a match we divide every second to last set into its outcome. The dependent variable, set score, shows the results of this approach. Again the variable is binary "1" for win and "0" for runner-up.
Table 3 and Table 4 show three main results. First we see almost no difference between the rounds. No single round yields a stable statistically significant advantage for a player. For example, on the one hand players have a significant advantage when they win the second to last set 6 - 2 in round 3, on the other hand players have a significant disadvantage when they win the second to last set 7 - 5 in the final. In addition to these seemingly random results in each round, we do not see any pattern between rounds. Therefore, we conclude that players do not behave differently from round to round.

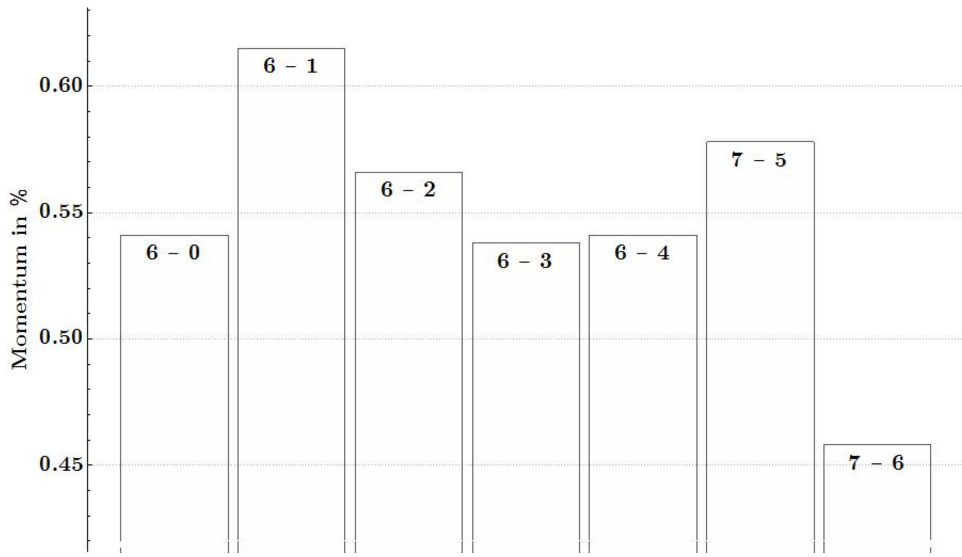
The second result concerns all set scores except the set score 7 - 6. Figure 1 shows the results from table II. The y-axis displays the chance to win the last set, the x-axis displays the set scores. All set scores, except the set score 7 - 6, yield a higher chance to win the last set. Players have a significant advantage of up to 60% to win the last set after winning the previous set.
However, our last result concerns the set score 7 - 6 (i.e. a player wins through a tie break). We see, that if a player won the second to last set in tie break, he faces anti-momentum in the last set. A player only has a 45.8% chance to win the last set when he won the second to last set in tie break. Anti-momentum then means that a player has a lower chance to win the last set even though he won the second to last set. This result is visible in Figure 1. The set score 7 - 6 is a clear outlier in both cases.

Table 4: Set score approach.

Set score	6 - 0	6 - 1	6 - 2	6 - 3	6 - 4	7 - 5	7 - 6
Round 3	0.157	-0.0835	0.147*	0.000724	0.0320	0.0420	-0.00248
	(0.173)	(0.0823)	(0.0661)	(0.0564)	(0.0553)	(0.0837)	(0.0668)
Round 4	-0.0607	-0.190	0.00598	-0.00736	0.135	-0.0557	0.00184
	(0.194)	(0.115)	(0.0874)	(0.0706)	(0.0729)	(0.0972)	(0.0798)
Quarterfinal	0.201	0.0533	0.000514	-0.133	0.0709	-0.173	-0.0240
	(0.165)	(0.189)	(0.141)	(0.0934)	(0.0900)	(0.133)	(0.107)
Semifinal	0.499*	-0.00781	0.149	0.0116	-0.0205	0.121	0.0372
	(0.206)	(0.179)	(0.145)	(0.125)	(0.142)	(0.169)	(0.126)
Final		0.121	-0.514***	-0.167	0.348	-0.662***	-0.118
		(0.234)	(0.0865)	(0.147)	(0.218)	(0.0663)	(0.194)
Ranking	-0.102***	-0.00471	-0.0409**	0.00470	-0.00581	0.0121	0.0445***
	(0.0260)	(0.0180)	(0.0133)	(0.0112)	(0.0114)	(0.0159)	(0.0128)
3 sets previous match male	0.216	0.0288	-0.00183	0.0744	-0.0407	-0.0106	0.00705
	(0.126)	(0.0851)	(0.0733)	(0.0544)	(0.0544)	(0.0855)	(0.0618)
4 sets previous match male	0.0604	0.0567	-0.0829	0.0745	-0.101	0.137	0.0137
	(0.200)	(0.0888)	(0.0803)	(0.0602)	(0.0655)	(0.0915)	(0.0677)
5 sets previous match male	0.187	-0.124	0.000690	0.104	-0.0775	0.252**	-0.0419
	(0.217)	(0.138)	(0.0969)	(0.0733)	(0.0713)	(0.0965)	(0.0817)
2 sets previous match female	-0.0624	-0.0438	-0.110	0.0655	-0.0614	0.0105	0.0235
	(0.188)	(0.117)	(0.0900)	(0.0776)	(0.0785)	(0.114)	(0.0953)
3 sets previous match female	-0.333*	-0.120	0.0293	-0.0158	-0.0549	0.183*	-0.0288
	(0.140)	(0.0981)	(0.0741)	(0.0639)	(0.0655)	(0.0888)	(0.0892)
Female	0.247*	0.0192	-0.103	0.0507	-0.0788	-0.0367	-0.00830
	(0.117)	(0.0675)	(0.0583)	(0.0458)	(0.0451)	(0.0676)	(0.0627)
Home Advantage	-0.122	-0.0147	0.0865	-0.00253	0.0120	-0.0802	-0.125
	(0.157)	(0.0827)	(0.0746)	(0.0535)	(0.0552)	(0.0847)	(0.0665)
FE Tournament	Y	Y	Y	Y	Y	Y	Y
Constant	0.541***	0.615***	0.566***	0.538***	0.541***	0.578***	0.458***
	(0.119)	(0.0644)	(0.0514)	(0.0398)	(0.0394)	(0.0625)	(0.0501)
Observations	123	411	606	1,001	985	450	692
R-squared	0.203	0.037	0.048	0.009	0.018	0.047	0.027

Robust standard errors in parentheses
*** $p<0.001$, ** $p<0.01$, * $p<0.05$

Figure 1



DISCUSSION

Table 3 analyzes different rounds with the binary approach. We observe that players have momentum, with a 54.2% chance to win the last set (assuming all control variables are "0"). In the introduction of the paper we explained how momentum was introduced in basketball. In basketball, researchers use the "hot hand" as a synonym for momentum. This means that a player has a high probability to make the consecutive shots he takes. The definition includes the concept that a player benefits from momentum even though he does not hit every shot.

The concept of momentum is misinterpreted in tennis when using the binary approach. Winning a set in tennis has different meanings depending on the winning score (7 - 6 or 6 - 0). An opponent constantly challenged a player if a set is won through e.g. a tie break (thus, winning 7 - 6) or in overtime (viz. (7 - 5). It can be the case, that after winning a game the opponent directly countered the player. Thus, winning a set in such a situation only results in a benefit for the match but it does not give the player momentum. Momentum is applicable only when players benefit from a clear advantage.

The intuition from Table 3 is straightforward. Players have a 4.2% higher chance to win the last set than their opponents. These results change completely when we include the set score in Table 4. We observe a considerably higher momentum for every set score except for 7 - 6.

When a player wins the second to last set in tie break (winning 7 - 6) he has a significantly lower chance to win the last set than his opponent. Therefore, a player has anti-momentum after winning a set in tie break. One explanation for this counterintuitive result is that players need control over a match to succeed. Without controlling a match, players are not able to influence the match in their desired direction. Our results support the control theory (Rotter, 1966). Control theory states " . . . one should expect to succeed to the extent that one feels in control of one's successes and failures." (Eccles & Wigfield, 2002, p.111) A player evaluates a tie-breaking win (7 - 6) as a negative outcome. Beating another player in a tie-breaker is the closest possible margin to win a set. Although the player wins the second to the last set, the player loses control over the match. Thus, a player is disappointed that he beat his opponent only in a tie-breaker and not with a higher margin. This loss of control leads to a loss in the player's success perception; the player has anti-momentum.

We do not find any empirical support for including the variable *rounds*. No round shows a significant advantage or disadvantage for a player. While including rounds makes sense from a theoretical perspective, we do not observe any statistical significance or pattern. However, the same pattern is visible for both home advantage and the gender of the player. Thus, the variable could still have an influence in future research.

CONCLUSION

We examine in this paper whether tennis players benefit from momentum. First, we analyze our data with the classical binary approach. We find momentum for players; however, we think that set scores are decisive factors when evaluating a match. Thus, limiting a set outcome to win or lose unnecessarily narrows the dataset. Second, we include set scores and tournament rounds to analyze the data. We do not find any significant effects for the different tournament rounds. However, the set score approach, in contrast to the binary approach, shows a strong momentum for every set-score except for a tie break.

Nonetheless, our analysis is far from complete. Future research could incorporate whether player characteristics (e.g. age, handedness, or effect of a wild card) influence the results of this paper or influence momentum. In an ideal dataset we would be able to include the results of all sets in a match. This follows the intuition that the outcome of every set is important to assess momentum. We measure tiredness by the amount of sets played in the previous match in the same tournament. A more complete measure could incorporate how many tournaments a player attended in a specific time period. Additionally, an analysis in combination with the betting market could observe if bettors exploit knowledge regarding the set scores or if this information is included in already the odds.

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ARE WOMEN OR MEN BETTER TEAM MANAGERS? EVIDENCE FROM PROFESSIONAL TEAM SPORTS

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We empirically compare the performance of female and male team managers. We find that female team managers never perform worse than male team managers. Additionally, we find that specialized experience has no influence. Specialized experience means having worked previously as an employee in the same industry. Our dataset consists of female and male managers in the German women soccer leagues and the North American women basketball league. Managers in team sports usually have exactly the same tasks (selection, coordination, and motivation of team members) as team managers in other industries. Our results provide important implications for industries, companies, and clubs who oppose employing female team managers.

INTRODUCTION

In most industries, companies employ teams to perform tasks. For example R&D teams create and develop new products and services, marketing teams are responsible for selling new and existing products, and production teams optimize plant operations. These teams consist of several team members and a team manager. The team manager in a business environment is responsible, to some extent, for the staff (e.g., hiring and laying off employees), communication (e.g., managing goals and mission of a team), and training (e.g., improving the employees skill set).

In our analysis we define sports coaches as team managers and players as team members. A team manager in sports is, similar to team managers in other industries, responsible for the performance of the team. The selection, supervision, and training of team members, as well as devising tactics and communicating with media define the remit of team sports managers (Goddard & Sloane, 2014). As the responsibilities of managers and team leaders are similar, numerous authors make this connection (Marsh, 1992; Clark, 1999; Ladyshewsky, 2010).

The representation of female team managers in European professional sports leagues (Hovden, 2013) or North American intercollegiate sports (Acosta & Carpenter, 2014) is very limited. Some European women soccer leagues, the North American basketball WNBA and the tennis Fed Cup and Hopman Cup are examples of sports competitions employing a significant number of female team managers. We examine if this limited representation is simply due to differences in performance and whether professional clubs employ fewer female managers because they simply perform worse.

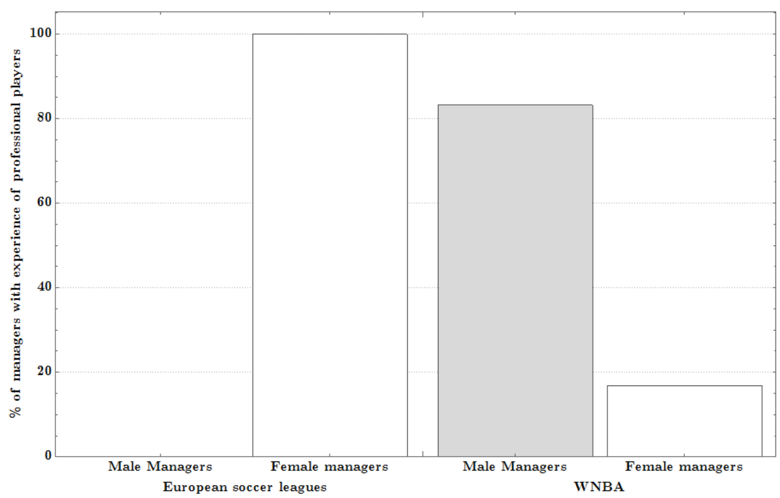
We compare the performance of women team managers with men team managers in the North American women basketball league (WNBA) and the three top European women soccer leagues (France, Germany, and Norway). This dataset allows us to avoid most of the shortcomings that papers analyzing the performance of female and male team managers report.

Team managers in these leagues have very different characteristics: In the WNBA we compare female and male managers who were professional players previously in their careers. Thus, all coaches in the WNBA have specific experience in their work environment, i.e., all managers worked as employees in the same industry (see Figure 1). The right side of Figure 1 shows that approximately 80% of managers with professional player experience are male in the WNBA. In the European case we compare female coaches with experience as professional players with male coaches without this experience. Male managers with experience as professional players do not work in women's soccer leagues. Most of them are employed as managers for male teams. The left side of Figure 1 shows that 0% of managers with professional player experience are male in the European leagues in our study. In the WNBA a significant number of both male and female coaches have professional experience as players. We therefore have two case studies: WNBA and European soccer leagues.

Our study contributes an accurate measure of performance to the existing literature on gender differences between female and male team managers.

Our dataset also allows us to measure the skill set of the team members, which is sometimes impossible in other sectors, and include the specialized experience of managers. In addition, we are able to compare team managers within the same sector and avoid biases that may appear when comparing teams performing in different sectors. Finally, our empirical analysis allows us to argue that the under-representation of female team managers in this context is not due to performance differences.

Figure 1 - Managers with specialized experienced.



LITERATURE REVIEW

Leading and managing teams is an important task in order to be successful. Therefore, a substantial amount of research on the different aspects of team management exists. Several authors examine team management to improve surgical procedures (Crysdale et al., 2006; Friedland et al., 2011; Stephens et al., 2006), to increase revenue in large corporations (Erhardt et al., 2003; Deszö & Ross, 2008; Ahern & Dittmar, 2012), or to improve the performance of nongovernmental organizations (Korten, 1987; Lindenberg, 2001; Smillie and Hailey, 2001). This is a brief compendium of the extensive literature analyzing team management.

Many of the studies that analyze differences between female and male team managers have shortcomings when measuring the performance: First, researchers use the stock market to analyze companies' performance across different sectors. These analysis have the drawback that the whole company represents one team. It is unreasonable to assume that a team manager's performance is visible for a team consisting of a very large number of team members. Also, the authors base their theoretic work on the efficient market hypothesis which has been criticized by numerous authors (Basu, 1977; Fama, 1998; Shiller, 2000). For other areas (e.g., medicine or NGO's), it is equally difficult to measure team performance.

Second, many studies face difficulties when assessing the talent and skills of individual team members (e.g., surgeons, or employees in NGO's), which have an important influence on teams' performance. Most ignore these problems by omitting individual performance.

Third, most authors neglect or do not specify the experience of team managers. Tesluk and Jacobs (1998) argue that the specification of the experience source is important because the context in which experience is gained might have an influence on performance. Several researchers examine that the education of team managers significantly correlates with the outcome of teams and companies.

Finally, several authors compare companies or teams from different sectors or industries (e.g., Kalleberg & Leicht, 1991; Erhardt, Werbel, & Schrader, 2003; Wolfers, 2006; Elsaid & Ursel, 2011; Khan & Vieito, 2013; Post & Byron, 2015). However, the economic or general conditions for teams differ significantly from sector to sector. For example, while most sectors have to cope with a significant loss of demand during an economic downturn, many companies have unchanged or increased demand for their products (Dave & Kelly, 2012; Smith, Ng, & Popkin, 2014). Another example is surgery. The success (and thus performance) rate of a team of cardiothoracic surgeons is generally different than the success of a team of trauma and orthopaedic surgeons. Therefore, it is important to compare teams in the same sector.

The sports industry, which is under-examined in the team management literature, provides us with an ideal scenario for four reasons: First, we have an exact measurement of team performance - points per game. This variable is important because it determines the success of team managers. Points per game in a league defines the success of teams.

Second, we have sufficient information to measure the skill set of team members. In other contexts, it is difficult to measure the skill set of team members. Nonetheless, the team members play an important part in the final performance. In our data we distinguish between high- and low-ranked national players, players receiving individual performance awards, and players skills when they join a team.

Third, we compare teams in the same sector. Teams competing in the same league face the same opponents and work under similar conditions. Thus, the use of sports data allows us to avoid comparisons between companies in different sectors.

Finally, we examine and specify the previous experience of team managers in the sports industry. We know if managers were professional players previously in their career. This is valuable experience for managers as they had to compete in a similar professional environment. During their time as professional players, managers receive specialized experience in for example, technical or physical training. This is a valuable asset for future managers in sports. Gaining experience as a professional player in sports is similar to receiving specialized education and training in other industries. Additionally, for the WNBA data we know how many years managers worked in the sports industry.

Many researchers examine the under-representation of female team coaches (Bracken, 2009; Walker & Bopp, 2011). Furthermore, the lack of role models (Avery, Tonidandel, & Philips, 2008), gender stereotypes (Burton, Barr, Fink, & Bruening, 2009), or self-efficacy issues (Cunningham, Dohert, & Gregg, 2007) are often identified as obstructions for females.

However, no research examined if women team managers underperform when compared to male team managers under similar conditions in the same sector. Negative reactions and attitudes towards women in management positions are rational only if evidence exists supporting the notion that female team managers underperform when compared to their male counterparts. As team managers in sports and other industries share similar responsibilities (e.g., selection, supervision, coordination, motivation of team members), our results provide new evidence regarding gender differences in performance.

THEORETICAL IMPLICATIONS

Several researchers examine performance differences for male and female managers. Kalleberg and Leicht (1991) observe gender differences for small business holders. They analyze companies in various sectors (viz., health, computer sales, computer software, food and drink) and find no performance difference between men and women. Wolfers (2006) observes diversity for S&P 1500 companies. He finds no significant difference in performance between teams with either a male or a female CEO. Deszö and Ross (2008) examine CEOs and find no positive correlation between performance and female managers. Smith, Smith, and Verner (2006) study the influence of women in team management positions for 2500 companies from the Danish stock market. They find a positive correlation between companies' performance and women in team management positions. Post and Byron (2015) perform a meta analysis of numerous studies regarding female participation in the board of directors. They show a positive relation between diversity in the board and accounting returns.

All previously mentioned papers use financial outcomes (e.g., Tobin's Q) to assess the performance of female and male managers. However, these measures are influenced by many other factors and cannot completely incorporate the managerial influence (Kulik & Metz, 2015). In our study, the sports dataset allows us to include a performance measure (i.e., game victories) that is more associated with managerial decisions.

The literature highlights that female managers act differently than their male counterparts and possess unique perspectives that influence group operations (Kulik & Metz, 2015). Moreover, Stoker, Van der Velde, and Lammers (2012) find that female employees have a stronger preference for women in management positions, which also influence the performance of a team. However, the positive influence of these unique characteristics on final performance outcomes is not obvious in the literature. As described in the previous section, researchers find ambiguous results. Although it is argued that organizational outcomes (e.g., social responsibility, internal group processes, or determined management practices) could be improved with females in management positions (Kulik & Metz, 2015), the final outcome might not differ much. Researchers consider, in general, females' transformational management style to be effective in most organizations nowadays. This effect could be diminished in a sports organization. For example, senior female players whose opinions weigh heavily on teams' decision processes and strategies can provide teams with the unique "female" perspective. The combination of female senior players and male coaches is an heterogeneous group that could work similarly to a mixed directory board. Therefore, we cannot assume that the gender of the manager is per se an advantage for teams or organizations:

Hypothesis 1: Female and male managers do not outperform each other.

Leadership styles of female managers may not result in significantly better final outcomes compared with male managers. However, the glass cliff literature shows how female managers are often appointed in more risky and precarious positions (Ryan & Haslam, 2005). The reason why the glass cliff persists is that female managers are perceived by owners as having the necessary skills to cope with difficult situations and being more risk averse (Kulik & Metz, 2015). For instance, Elsaid and Ursel (2011) and Khan and Vieito (2013) use the S&P 1500 to compare the effect of female and male managers on companies' risk levels. Both studies find that female managers are more risk averse than their male counterparts. Thus, the comparison between female and male managers in companies might be biased as women often have to achieve similar results in more challenging situations.

We contribute to this literature by analyzing the preconditions of team managers in their workplace (i.e., quality of players available, previous performance of the team and other contextual factors). We show that the glass cliff phenomenon also plays a role in sports organizations. Because of sports cycles (i.e., senior players retirements, financial crisis, losses of sponsors etc.), teams end up in difficult situations where inexperienced or low profile players have to outperform. In such a scenario, it is likely that, just like in any other organization, owners prefer to hire female managers who are more risk averse. Moreover, women are seen as capable of providing teams with communication channels (Melero, 2011) and a more democratic and participative spirit (Dezsö & Ross, 2012), which is determinant in the absence of high profile team members. Therefore, we formulate the following hypothesis:

Hypothesis 2: Female team managers work under worse preconditions than their male counterparts.

The positive effect of the education of managers on the performance of teams is generally accepted in the literature. Jalbert, Rao, and Jalbert (2002) show that return on assets for large companies in the US depends on the education of managers. Bhagat, Bolton, and Subramanian (2010) find a positive short-term relationship between highly educated managers and firms' performance. However, conceptual education programs often fail to promote the development of practical skills that are required for managers later on in the labor market.

In sports organizations, the federations require professional managers to obtain a specific licence/certification that permits them to train professional teams. Thus, to obtain this certification managers need to enroll in specific courses that integrate both practical and theoretical sport-specific knowledge. We believe the education and experience levels of managers become less important when specific training is required to access the job.

Human Capital and Learning theories suggest that job experience should improve performance levels as employees incorporate specific-knowledge and develop skills and abilities (Sturman, 2003). Thus, active senior team members can reduce the impact that managers with specialized experienced (i.e., managers who have been former professional player) might have on teams' performance. For instance, active senior team members can provide teams and managers with an experienced and unique perspective fruits of their participation in the competition. Thus, male and female managers with no specialized experience (i.e., managers without experience as professional players) can use the experience of their active players to improve the performance of the teams. We believe that managers education and specialized experience are not crucial variables in organizations with senior active members and specific training requirements. We, therefore, formulate the following hypothesis:

Hypothesis 3. Team managers with specialized experience do not perform better than other team managers.

In the following section we describe and analyze our data. We then present two studies from professional women sports competitions (basketball and soccer) to test our hypotheses. Afterwards, we discuss our results and finish with a concise conclusion.

STUDY 1 - NORTH AMERICAN BASKETBALL LEAGUE

In Study 1, we examine the WNBA. This league is unique because most female and male managers were previously professional players. Clubs in the WNBA have consistently employed female managers. In the 2015-2016 season 5 of 12 managers are women. Women managers have worked in the WNBA since, and Mary Murphy).

Basketball is a team sport in which two teams of five players each try to score more points (getting the ball through an elevated hoop) than the opponent team. A basket is worth two points (three points if made outside of the three-point arc and one point if it is a free throw). Games consist of four periods of ten minutes with a two-minute break between each quarter. The win is for the team achieving the highest number of points.[1] The focus of study 1 is to analyze managers with similar experience. For male managers, we define specialized experience as having played in the national basketball association (NBA). For female managers, we define specialized experience as having participated in either the WNBA or one of its predecessors.[2] All managers in this analysis have previously worked as employees in the same industry and therefore have gained specialized experience.

This employment gives managers the possibility to benefit from technical or physical training, for example. Several authors examine that team managers' education significantly correlates with the outcome of teams and companies. Jalbert et al. (2002) show that return on assets for large companies in the US depends on the education of managers. Bhagat et al. (2010) find a positive correlation between highly educated managers and the performance of firms in the short-term. We therefore include whether or not managers have specialized experience. In addition to the specialized experience we know how many years of experience the WNBA managers have.

The WNBA is one of very few leagues where female manager are active (Acosta & Carpenter, 2014; Kamphoff, 2010; Thorngren, 1990). No other league yields such a consistent data set for male and female managers. However, as the WNBA is a relatively new league, our data is restricted to the time-period 2000-2015. The WNBA is an attractive workplace for male and female managers. Several managers have worked in both the male and female leagues.[3]

Study 1 - Data

[1]For additional information regarding basketball rules see WNBA (2014).

[2]The WNBA only exists in its present form since 2000.

[3]Coaches who worked in both leagues are, e.g., Michael Cooper and Paul Westhead.

Table 1 provides an overview of the data we use in Study 1. All data is publicly available at basketball-reference.com.

Variables

As a primary outcome variable for performance we choose if a team wins a game *Game result*. This is the most complete measurement available to approach teams' success; it is comparable to companies' performance. Several authors identify points per game as the focal point for professional team sports clubs (e.g., Vrooman, 1995; Késenne, 1996; Dietl, Lang, & Werner, 2009). Thus, using the winning percentage after every game is an approximation for points per game.[4]

To account for teams' budgets we include game attendance, people living in a close area, and playing talent. We include *Attendance* to measure the average number of people attending a home game in a season. As this number might be restricted by the people living close to a club, we also control for the *total population who has the possibility to attend a game in a 20 mile radius* (cf. Buraimo & Simmons, 2009; Forrest, Simmons, & Feehan, 2002). Game attendance is an important source of revenue for clubs because supporters pay an entrance fee. We summarize game attendance and people living close by in *Club Controls*. Because the league is divided in two conferences (eastern and western) we add a variable to capture their potential influence.

In several models for professional team sports leagues, playing talent is the most important expenditure for the budget of a team (Dietl et al., 2009; Madden, 2011). Therefore, our aim is to clearly differentiate between the players in a league to measure their skill set.

To evaluate playing talent we use *Allstars and MVP*. The variable Allstars consists of players who are voted into an Allstar team. The variable MVP includes players who have been a MVP in one of several categories, i.e., Defensive Player of the Year, Rookie of the Year, Finals Most Valuable Player, or Season MVP. For these variables (Allstar and MVP), players are evaluated based on their performance.

To compare the incoming playing talent in a team, we examine the draft. In a draft, players who enter a league for the first time are ranked according to their skills and previous performance. Thus, a higher ranked draft position

[4]It is also appropriate to use the position before/after the playoffs. However, the results in the analysis do not differ significantly when using either of these methods.

Table 1: Cross correlation table - WNBA.

Variables	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12	13
1 - Female manager	0.20	0.40	1.00												
2 - Male manager	0.80	0.40	-1.00	1.00											
3 - Manager age	51.95	9.05	-0.49	0.49	1.00										
4 - Manager experience	20.83	11.20	-0.41	0.41	0.77	1.00									
5 - MVP	0.26	0.56	-0.01	0.01	0.05	0.16	1.00								
6 - Allstars	0.69	0.80	-0.16	0.16	0.02	0.07	0.45	1.00							
7 - Manager MA education	0.39	0.49	-0.23	0.23	0.18	-0.04	0.05	0.12	1.00						
8 - Manager BA education	0.50	0.50	0.11	-0.11	-0.14	0.08	0.02	-0.01	-0.73	1.00					
9 - African American Manager	0.16	0.37	0.19	-0.19	-0.31	-0.38	-0.10	-0.11	-0.15	0.18	1.00				
10 - Draft 1st pick	0.23	0.42	-0.03	0.03	-0.17	-0.09	0.04	-0.09	-0.07	0.09	0.04	1.00			
11 - Draft 2nd pick	1.44	3.63	0.17	-0.17	-0.10	-0.06	-0.02	-0.10	-0.07	0.08	0.02	0.15	1.00		
12 - Population 20 mile	2029528	2097714	-0.05	0.05	0.08	0.17	-0.09	-0.04	0.05	-0.09	-0.03	-0.10	-0.03	1.00	
13 - Attendance	8213	2070	-0.03	0.03	0.03	0.16	0.07	0.10	0.25	-0.26	-0.27	-0.19	-0.01	0.42	1.00

should represent a higher playing talent. As the league has several draft rounds and teams have several choices, we distinguish between the *first, second, and third draft round* and the *first and second teams' pick*.

We include *age*, *experience*, *education*, *race*, and *gender* of the managers. We clearly differentiate between experience as a manager (captured in the variable experience) and specialized experience as a player. Specialized experience means that the manager worked as an employee in the same industry. Furthermore, we differentiate between three different education levels; no college degree, undergraduate degree, graduate degree. Last, we include the race of the manager. We only distinguish between African American and White American[5] managers. Every manager who coached a team for at least half of the games in one season is included in our analysis.

Study 1 - Analysis and Results

In Table 2 we perform a regression with robust standard errors.[6] Our dependent variable is a 1 if a team wins a game and 0 if a team losses a game. To account for the draft picks we include the first round.[7]

Other measures to correct for teams' budget are MVP, Allstars, attendance, and population in 20-mile radius. For managers' characteristics we add age, experience, race, education, and gender. In the first regression only age and experience of the manager are included. Additionally, we include year fixed effects. We then stepwise include the other variables to show their impact.

We find that almost no variable, that we use to assess teams' budget is statistically significant except for playing a game at home. While having an Allstar has a positive effect on the winning probability other effects have only a negligible impact (e.g., age and experience of the manager). No performance differences exist between female and male managers.

To further analyze the data we examine the different preconditions of female and male managers using the Oaxaca-Blinder decomposition (Table 4). To evaluate gender or group differences (e.g., between rich and poor citizens) the Oaxaca-Blinder decomposition is frequently used in labor economics (e.g.,

[5]Official terminology from the US Census Bureau.

[6]A logit/probit model is also appropriate. However, it does not yield statistically significant results.

[7]Including another draft round (2nd and 3rd pick) has no statistical significance.

Table 2: Regression WNBA.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female manager	-0.006	0.000	0.001	-0.000	0.011	0.015	0.015	0.018
	(0.014)	(0.015)	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)	(0.016)
Age of manager	-0.000	-0.001	-0.001	-0.001	-0.000	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Experience of manager	0.001	0.001**	0.001	0.002**	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Home game	-0.616***	-0.616***	-0.616***	-0.616***	-0.616***	-0.616***	-0.616***	-0.616***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
MVP					0.021*	0.022*	0.023*	0.026**
					(0.009)	(0.009)	(0.009)	(0.009)
Allstars					0.042***	0.040***	0.041***	0.039***
					(0.007)	(0.007)	(0.007)	(0.007)
Draft 1st Pick						-0.009	-0.010	-0.007
						(0.013)	(0.013)	(0.013)
Draft 2nd Pick						-0.004**	-0.004**	-0.004**
						(0.001)	(0.001)	(0.002)
Education FE		Y	Y	Y	Y	Y	Y	Y
Race FE			Y	Y	Y	Y	Y	Y
Conference FE				Y	Y	Y	Y	Y
Club controls							Y	Y
Year FE								Y
Constant	0.614***	0.624***	0.631***	0.633***	0.574***	0.594***	0.614***	0.587***
	(0.039)	(0.043)	(0.043)	(0.043)	(0.044)	(0.046)	(0.056)	(0.058)
Observations	4,883	4,883	4,883	4,883	4,883	4,883	4,883	4,883
R-squared	0.447	0.448	0.448	0.448	0.455	0.456	0.456	0.458

Robust standard errors in parentheses
*** $p<0.001$, ** $p<0.01$, * $p<0.05$

Stanley & Jarrell, 1998; Weichselbaumer & Winter-Ebmer, 2005; Yun & Yun, 2004). The decomposition divides the performance differences between male and female managers in unexplained and explained variation. The differences are explained with the explanatory variables. Practically speaking this means that we compare two groups and evaluate if they have different preconditions which influence their performance. Accordingly, in our case we examine if females and males have different/similar performance because of different/similar preconditions.[8]

Table 3: Oaxaca-Blinder decomposition WNBA.

VARIABLES	
Males	.305***
	(.007)
Females	.284***
	(.014)
Explained	.014
	(.010)
Unexplained	.006
	(.019)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3 yields several interesting results.[9] We see that the performance between males and females is very similar. Additionally, we find that although female managers have worse preconditions they are negligible small in our

[8]A propensity score matching approach is also appropriate (for a more detailed discussion regarding the Oaxaca-Blinder decomposition and propensity score matching see Kline (2011).)

[9]We omit all non-significant effects, as the analysis is otherwise too extensive.

analysis.

Study 1 - Discussion

In study 1 we compare female and male managers who were professional players in their previous career. We find support for Hypothesis 1 because neither female nor male managers significantly outperform each other in the WNBA. In any case, female managers do not perform worse than male managers as the samll number of coaches may suggest.
Our results do not confirm Hypothesis 2. We do not find that female managers in the WNBA work under significantly worse preconditions, as the glass cliff literature has previously found in other industries. Otherwise, the Oaxaca-Blinder decomposition would show differences in the covariates. Additionally, because of the idiosyncratic characteristics of the WNBA we need Study 2 to further test this hypothesis.

In contrast to many women soccer leagues, where the manager compensation is rather low (e.g., Germany), many male managers see the WNBA as an attractive workplace. Thus, both male and female managers have similar levels of experience (i.e., both have been former professional players). However, in order to prove Hypothesis 3 we must examine if specialized experience influences the managers' performance. Therefore, in the next study we examine if the performance difference is the same when male and some female managers have less specialized experience.

STUDY 2: EUROPEAN SOCCER LEAGUES

In Study 2 we examine three top European women soccer leagues.[10] Women managers frequently have worked in these leagues in the early 2000's. In all three leagues, the percentage of women managers has sharply declined since 2008: France 27% in 2008 to 9% in 2014, Germany 33% in 2008 to 8% in 2014, and Norway 36% in 2008 to 18% in 2014.
Soccer is a team sport in which two teams with 11 players try to score more goals (getting the ball into the opposing goal) than the opponent to win the game. Games consist of 90 minutes (2 periods of 45 minutes) with a 15-minute half-time break. A soccer team receives three points for a win, one

[10]The leagues in France, Germany, and Norway are three of the five largest women soccer leagues in Europe with respect to total budget for women's soccer (UEFA, 2014).

for a draw, and zero for a loss.[11] These leagues are ideal because a significant amount of data is publicly available (for France since 2004 and for Germany and Norway since 2000). We use these leagues to explore if females with and without specialized experience (i.e., being former professional players) perform differently compared to males without specialized experience.

Study 2 - Data

Our data comes from various sources. For league statistics (i.e., rank, name, and age of the team manager; player of the year; and game attendance) we use data from transfermarkt.com (authors using the same source are e.g., Hardman & Iorwerth, 2014; Lee, Jang, & Hwang, 2014; Parsons & Rohde, 2015). For older data many observations about name and age of the manager were missing. Therefore, we contacted the soccer clubs or the appropriate federation directly. We had to omit approximately 0.5% of the data because either the gender or the age of the manager was unclear or untraceable. Unfortunately, no reliable information about the management experience was available. We use the Fédération Internationale de Football Association (FIFA) for data about aggregate team information (national team ranking). All the above mentioned variables are shown in Table 4.

Variables

The performance of a club is normally assessed by a team's position in the league. The position depends on the points that a team makes throughout a season. Thus, comparable to the WNBA case, we use the *Game result* as a dependent variable. That is, a team receives 3 points for a win, 1 for a tie, and 0 for a loss.

Additionally, we again control for the following variables: *age* and *gender* of the manager, *attendance at a home game*, and *people who have the possibility to attend a game in a 10 mile radius*. We decrease the radius from Study 1 by 10 miles, as US customers are more willing to travel a longer distance than European customers (Pucher, 1988; Pucher & Lefever, 1996; Giuliano & Narayan, 2003).[12] Again, we suppress attendance and people living close by in a *club control variable*.

[11] For additional information regarding soccer rules see FIFA (2015).

[12] Changing the radius has no statistically significant impact on the results.

Table 4: Cross correlation table - European Soccer Leagues.

Variables	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 - Male manager	.75	.43	1.00														
2 - Female manager with specialized experience	.15	.36	-0.73	1.00													
3 - Female manager	.10	.30	-0.58	-0.14	1.00												
4 - Manager age	42.61	8.42	0.31	-0.24	-0.16	1.00											
5 - Home game	.50	.50	0.00	-0.00	0.00	-0.00	1.00										
6 - Player of the year	.07	.25	-0.00	-0.02	0.03	0.08	-0.00	1.00									
7 - Players Top 10 FIFA ranked	4.84	4.51	-0.02	0.02	-0.00	0.07	-0.00	0.35	1.00								
8 - Players Top 11-20 FIFA ranked	.39	.84	-0.08	-0.00	0.11	-0.01	-0.00	-0.02	-0.02	1.00							
9 - Players Top 21-30 FIFA ranked	.35	.76	0.05	-0.01	-0.05	0.12	0.00	-0.02	-0.06	0.07	1.00						
10 - Players Top 31-200 ranked	.64	.1.07	-0.01	0.10	-0.10	0.18	0.00	-0.02	-0.17	0.07	0.26	1.00					
11 - Attendance	427	466	0.11	-0.08	-0.07	0.34	-0.00	0.27	0.27	0.20	0.15	0.18	1.00				
12 - Population 10 mile	545290	774092	0.04	-0.11	0.07	-0.08	-0.00	0.02	0.43	-0.07	0.01	-0.00	0.02	1.00			
13 - France	.31	.46	-0.09	-0.01	0.15	-0.05	0.00	0.03	0.12	-0.27	-0.16	-0.02	-0.13	0.19	1.00		
14 - Germany	.37	.48	0.05	-0.01	-0.05	0.24	0.00	0.03	-0.25	0.18	0.30	0.38	0.45	-0.19	-0.51	1.00	
15 - Norway	.32	.47	0.04	0.03	-0.09	-0.20	-0.00	-0.06	0.13	0.08	-0.15	-0.37	-0.33	-0.33	-0.46	-0.53	1.00

Unfortunately, two variables from the previous case are not available; experience as a team manager and education. We choose not to include race because fewer than 1% are not white.

Naturally, national team managers try to choose the best players for their teams. Accordingly, we distinguish between players who play for a national team and those who do not. We use the FIFA national ranking to detect if players are playing for a high- or low-ranked national team. In this ranking the performance of a national team is evaluated and compared with all other national teams. To clearly assess the number and skills of international players, we divide the FIFA ranking into four categories and identify the number of players in a team playing in these FIFA ranking categories. Thus, we introduce the variables *national players from Top 10, Top 11-20, Top 21-30 and Top 31-200 FIFA ranked nations*.

To further assess the skill set of players we observe if a player is voted as the *best player of the year*. This variable is useful to detect playing talent which might not be visible in the FIFA ranking.

For managers we define specialized experience as having played in the highest soccer league (being closest to a professional career). Thus, we have three groups: males and females without specialized experience and females with specialized experience.

Study 2 - Analysis and Results

In Table 5 we show the results of the regression with robust standard errors. Our dependent variable is the game result. We include country and year fixed effects. We cluster our results at the country level.

We use the variables game attendance, player of the year, and national players. We add control variables step by step to show their influence on the performance of managers. In the second regression we add all player skills variables. Including them one at a time makes no sense and has no effect on the significance. In the third regression we add club characteristics and in the fourth regression we include league fixed effects and in the last regression we include year fixed effects.

Table 6 shows several results which are less important for our paper. Playing talent (viz., national players and player of the year) has a significant diminishing positive effect on rank. Additionally, as in the WNBA study, playing at home has a significant positive effect.

Table 5: Regression European Soccer Leagues.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Female manager					
Male manager	0.020	0.087	0.080	0.113	0.118
	(0.151)	(0.103)	(0.110)	(0.088)	(0.094)
Female manager	0.166	0.171	0.177	0.205	0.203
with specialized experience	(0.127)	(0.136)	(0.157)	(0.140)	(0.145)
Age of manager	0.016	0.009	0.006	0.006	0.005
	(0.009)	(0.006)	(0.006)	(0.004)	(0.004)
Home game	0.216*	0.219*	0.219*	0.219*	0.219*
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)
Player of the year		0.245**	0.186**	0.167*	0.162*
		(0.018)	(0.013)	(0.039)	(0.043)
National players Top 10					
FIFA ranked nation		0.119**	0.114**	0.113**	0.119**
		(0.005)	(0.004)	(0.004)	(0.007)
National players Top 11-20					
FIFA ranked nation		0.098**	0.081*	0.089*	0.089**
		(0.008)	(0.008)	(0.010)	(0.011)
National players Top 21-30					
FIFA ranked nation		0.061*	0.051*	0.062*	0.052*
		(0.014)	(0.010)	(0.012)	(0.006)
National players Top 31-200					
FIFA ranked nation		0.006	-0.007	-0.003	-0.016
		(0.028)	(0.017)	(0.012)	(0.008)
Club contols			Y	Y	Y
Year FE				Y	Y
League FE					Y
Constant	0.658	0.224	0.302	0.326	0.403
	(0.244)	(0.198)	(0.186)	(0.142)	(0.212)
Observations	9,302	9,302	9,302	9,302	9,302
R-squared	0.015	0.179	0.182	0.185	0.185

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

However, for this analysis the most important result from Table 5 is the effect that managers have on performance. We find no difference between females without specialized experience, females with specialized experience, and males.

Although the results from Table 6 are straightforward, we want to see if no performance differences exist because male or female managers have superior preconditions at their clubs (e.g., they have more national players at their disposal). Thus, we examine the differences between male and female managers with specialized experience using the Oaxaca-Blinder decomposition in Table 6. We use the fourth regression as it includes all control variables.

Table 6: Oaxaca-Blinder decomposition
European Soccer Leagues.

VARIABLES	
Males	1.458***
	(.015)
Females with specialized experience	1.529***
	(.037)
Explained	0.042*
	(.018)
Unexplained	-0.104**
	(.038)
Attendance	.020***
	(.001)
Age	.036***
	(.001)

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

Table 6 shows a short extract of the decomposition.[13] We see that the

[13] We omit all insignificant effects as the analysis is otherwise too extensive.

largest part of the differences between females and males is unexplained. The performance difference between female with specialized experience and males is about 0.07 points per game. The explained part is due to the attendance figures and age of the manager. This means that females have less visitors at their games and are younger.

Study 2 - Discussion

In study 2 we compare female managers, who were professional players in their previous career, with male and female managers who were not professional players. The results show that neither female managers nor male and female managers without comparable experience outperform each other. Therefore, Hypothesis 1 finds empirical support because female and male managers do not outperform each other. Additionally, the results support Hypothesis 3 as managers, in general, with more experience do not perform better than those without such experience.

Gottesman and Morey (2006) observe the connection between mutual fund performance and managers' education (for a similar study regarding Chinese companies see Huang, Yang, Xie, & Li, 2013). They find a positive relationship. Darmadi (2013) examines the correlation between companies performance, and the education of the board members. They also find a positive connection. Our findings show a different path. We find that experience (education) has no impact on the performance of teams possibly due to the specific coaching training requirements and the presence of senior active team members.

Regarding the preconditions women and men encounter when managing their teams, we find support for Hypothesis 2. Female managers work under significantly worse preconditions than male managers, which coincides with previous findings in the glass cliff literature. Although the largest part of the difference is unexplained, our analyses show female managers having lower attendance figures and being younger.

GENERAL DISCUSSION

Previous researchers focus on analyzing differences in performance when a company has a woman in a management position. Many researchers use the stock market to compare companies in several sectors. In most sectors, demand and labor fluctuation are divergent, which makes it considerably difficult to use the stock market as a reference point across sectors. Our study is independent of the stock market.

We examine how female and male team managers influence the performance of teams in the same sector. All clubs are equally affected by demand and labor variations. For that purpose, we conduct two studies with data from professional women sports leagues. Study 1 analyzes the North American women's basketball league, in which both female and male team managers have similar experience. Study 2 focuses on European women soccer leagues, where some females have specialized experience and male team managers and other female managers have no specialized experience. Both studies allow us to test not only whether female or male team managers perform better, but also the effect that the experience of team managers have on the performance of teams.

The results from the European case support the hypothesis that female team managers and male managers perform equally well. Therefore, we cannot reject Hypothesis 1. Although we find that that females work under worse preconditions in the European case we find no support that females have different preconditions in the WNBA. We therefore reject Hypothesis 2. Additionally, Hypothesis 3 finds empirical support as managers with specialized experience do not perform better than other managers in our studies.

Implications for Research

Our research provides new empirical evidence regarding gender differences in performance between team managers. The results show no difference in performance between teams with experienced male or female team managers. Similar results were found in previous studies that focus on females in CEO positions (Dezsö & Ross, 2008; Wolfers, 2006). Additionally, the European soccer case demonstrates that specialized experience has no effect. These results reject the notion that a positive correlation exists between women with specialized experience in management positions and performance (Smith et al., 2006).

Unlike other researchers studying the effect of gender on team performance (e.g., Erhardt et al., 2003; Khan & Vieito, 2013; Wolfers, 2006), our study focuses on teams in the same sector, thus, avoiding seasonal demand issues that appear when comparing multiple sectors.

Many researchers have been criticized for focusing on the efficient market hypothesis (e.g., Fama, 1998; Shiller, 2000). We use a dependent variable that allows us to accurately measure team performance. The use of ranking provides a specific and widely accepted benchmark to assess the performance of teams and the managerial influence.

Additionally, we contribute to the literature by including specialized experience (i.e., having worked as employee in the same industry). Study 2 results show that team managers with specialized experience perform as good as managers with no such experience. These results contrast with previous findings which report a significant correlation between the education of managers and companies' profits and performance (Jalbert et al., 2002; Bhagat et al., 2010).

Soriano and Castrogiovanni (2012) show that managers specific and general knowledge in a sector have a positive effect on companies' performance. They argue that having worked previously in a similar environment is highly correlated with productivity. Therefore, it is reasonable to employ team managers who have previously worked in a similar professional environment. However, in an industry like sports organizations, where managers often are required to obtain a license in a highly specific course, the effect of having or not previous experience could be diminished.

Thus, our results either show that specialized experience has no effect or that additional experience among highly experienced individuals has no effect.

Finally, this paper contributes to the glass cliff literature by analyzing the preconditions that female managers have when managing a team in a sport competition. This literature claims that women are often hired in more risky positions than their male counterparts (Ryan & Haslam, 2005), in part because they are perceived as having the managerial skills to outperform in difficult situations (Kulik & Metz, 2015). However, many of the previously mentioned studies that compare female and male managers' performance (e.g., CEO positions) only use lagged values of companies performance to control for the female effect. Thus, teams' preconditions are often not included in the analyses (e.g., different financial situations, less team talent or resources available).

In our study, we are able to examine whether the differences in performance between female and male managers are due to different preconditions that might influence the final outcome (e.g., more talented players in the team, higher attendance figures, more population living in a close area etc.). The WNBA and the European soccer leagues show different results. While the former does not present significant differences between female and male managers the latter shows how females are younger and coach teams with lower attendance. Due to this disparity, we cannot conclude that the glass cliff phenomenon is present in all sports organizations. However, we can argue that female managers do not perform worse than male managers, even in a setting where they are at a disadvantage (i.e., European leagues). Future research on performance differences between female and male managers should control for potential different preconditions reported in some industries.

Practical Implications

Beyond the theoretical contributions mentioned previously, this study also provides practical implications. Clubs, organizations, and companies should take these implications into consideration when hiring personnel in team management positions.

Research shows that women are keen to adopt a more democratic and participative management style than men in team management positions (Eagly & Johnson, 1990; Holmes, 2006). A participative management style is reported to have a positive impact on employees' satisfaction in both public and private sectors (Kim, 2002). Stoker, Van der Velde, and Lammers (2012) find that female employees, employees having previous experience working for a female team manager, and employees working in companies with a greater percentage of women in management positions have a stronger preference for females in management positions.

The negative reactions of owners and decision-makers towards women in management positions (Lee & James, 2007; Brunzell & Liljeblom, 2012) might be due to stereotypes rather than evidence. We find no evidence of females underperforming. Female team managers with specialized experience working at a younger age and with worse attendance figures (Study 2) manage to perform as well as males. Therefore, gender diversity in team management positions might be very valuable for industries, companies, and clubs. The argument that regulations to ensure diversity (e.g., quotas) lead to younger and less experienced team managers (Ahern & Dittmar, 2012), might have a different insight. In a setting where no quota has been implemented (i.e., sports clubs), we find female managers to be significantly younger than their male counterparts. This demographic characteristic of females in management positions has been also found in other industries (Kulik & Metz, 2015), and according to our study it does not seem to have anything to do with the implementation of regulations like quotas.

Our research shows that specialized experience, as previous involvement in professional environments, has no effect on performance. Other authors find a positive correlation between companies' performance and level of education of team managers and board members (Bhagat et al., 2010; Darmadim, 2013; Jalbert et al., 2002). Gottesman and Morey (2006) observe that managers holding MBA degrees in top ranked schools have a better performance than those from unranked programs. However, this evidence is not obvious in our results. Therefore, companies and organizations might find it valuable to identify potential differences in previous professional experience among the candidates especially if no specific training is provided.

Limitations and future research

Our work is severely limited by the number of observations in the analysis. For the European soccer leagues we gathered data over a 15-year period (2000 - 2015). The dataset for the WNBA is equally small. A larger dataset would further clarify the results of numerous explanatory variables. Due to the limited dataset, it is not possible to construct a sensible model with a longer time lag.

Missing data, especially the age and gender of some managers, exacerbate the problem of working with a small dataset. Unfortunately, no other soccer leagues in Europe provide a better dataset since female managers are underrepresented in all other leagues. Additionally, the lack of publicly available information limits the sample size.

In our analysis all team members have the same gender, i.e., all players are women. Thus, we have a somewhat distorted view of teams. In many cases, teams consist of both men and women. Unfortunately, we cannot incorporate a mixed-teams competition in our analysis.

A more complete dataset would include a better measurement of the quality of the players (e.g., the budget of the clubs). However, budget is not available in our study. Although our variables manage to explain part of the budget, an unknown size of the budget still remains unexplained. Thus, other explanatory variables have to fill this gap in the future (e.g., value of machinery and real estate a company holds). Finding a more direct approach to measure how either a female or a male team manager impacts the performance of a company is an interesting question for future research. While we use a quantitative method to assess performance, future research could use a qualitative approach to investigate the influence of team managers' performance on employees (e.g., through extensive surveys). Additionally, female and male team managers could have a different impact depending on the size and composition of teams.

Conclusion

We show in our analysis, with data from professional team sports leagues, that female team managers in no way underperform when compared to male team managers. Indeed, females outperform males when they have specialized experience. Naturally, our analysis has several shortcomings, which prevent us to fully generalize our findings.

Nonetheless, we are able to formulate implications. Our results show that it is crucial to include experience to assess the performance of team managers.

Our findings also provide us with the opportunity to formulate a few raw practical implications. Our practical implications are mainly directed to clubs and companies. We show that when hiring a team manager, clubs and companies should never base their decision only on the gender of a candidate. Gender per se is not a sensible indicator of performance. Experience in the same sector is a superior indicator for hiring a candidate.

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Curriculum Vitae

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